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ELECTRO-MECHANICS.—No. 2.

In case of the employment of small electro-magnets, or a great excess of battery power, the plan of changing poles works admirably well, for the changes are rapid, and the attractive and repulsive forces together keep up a continual action. There are, however, several objections to this plan of operation.

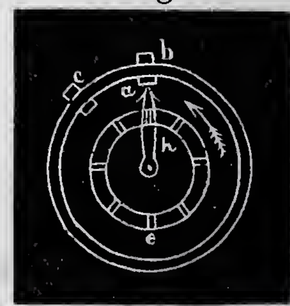
First. The repulsive forces are very feeble compared with the attractive forces, and the disparity between these forces is greater in electro-magnets than in permanent magnets.

Second. It is very important in using the repulsive forces, that the stationary and revolving magnets should be charged to the same extent, otherwise attraction would occur instead of repulsion. If two similar poles of electro-magnets are brought together, they will attract each other when one pole is much more highly charged than the other. The equalization of the charge in the revolving and stationary magnets is very difficult to obtain, and appears to be utterly impracticable where the engine is of any size. Besides various accidental causes, there is one prominent and principal cause. It has been before noticed that the charging of a magnet required time, and this generally in proportion to the size of the magnet. Now if we bear in mind that the cut-off or pole-changer of an engine must always work contemporaneously with the engine, then we shall see that if the engine revolves fast, the magnets which are to have their poles changed have not time to acquire their full charge. If the engine revolves slowly, then the magnets have more time to acquire their charge; but another difficulty follows if the magnets are of any size, viz., the retarding forces increase; and from several electro-magnetic engines of large size, which we have made and tested, we have not been able to fix upon any *working velocity.* They ought to have more power when working at a low velocity, and in fact they do; but the rate at which the greatest power is manifested, when the magnets and engines are large, is so very slow as to be unfavorable in most mechanical operations. This was not expected of the "*Lightning engine,*" but thus it is.

As said before, electricity is quick enough in its movements, but when it has to operate through the medium of electro-magnetism, it seems quite too slow for our purposes. In fact, the nature and effects of the retarding forces have been less studied in connection with electro-mechanics than other points of less importance. We are led here to notice a very common error upon the subject of electro-magnetic engines. We often hear the remark that it would be very easy to increase the power of a rotary electro-magnetic engine by increasing its diameter, and thus increasing the leverage. So we might, to a certain extent, if it were not for the very difficulty we have just mentioned. The further the magnets are from the centre of motion, the

more rapidly they have to move, and in addition to the extra weight we shall find that the magnets have less and less time to receive their charge, as they are placed remote from the centre, with a view to the increase of leverage. Thus there seems to be no reason for making an electro-magnetic engine of large diameter, except for the sake of room for magnets of a large size. Referring to Fig. 1 we shall understand readily the nature of this difficulty in charging magnets in an engine, and equalizing the intensity of charge in the revolving and stationary systems. The revolving system of magnets is represented in the magnetic poles *a d*; the stationary system by *b c*; the cut-off or pole-changer is represented by the cylinder of insulated segments *e*, and the conducting-arm *h*. We must suppose that there are as many segments in the pole-changer as magnets in one of the systems. In the present plan, the conductor *h* is supposed to be moving in the direction of the arrow, and the magnetic pole *a* has been attracted up to that point where its change of poles must commence, and repulsion to ensue between *a* and *b*, and attraction between *a* and *c*. Before change of polarity can take place, the whole charge of magnetism must be neutralized, and a reverse polarity established. It takes time to neutralize the charge and time to establish the charge of the opposite character. The pole *a* is moving in the direction of the arrow, and as the arm *h* passes from one segment to the next the change in the magnet commences. During therefore the whole time of the subsidence of the magnetism, the pole *a* is moving away from pole *b*, which retains its permanent charge, and they attract each other, and the motion may be such that *a* will arrive opposite to *c* before it has lost its charge, and the reverse polarity commenced, and therefore instead of being attracted by *c* it may be to some extent repelled by it. Hence it may be pushed back by *c* and pulled back by *b*. If the reverse polarity commences before *a* has passed beyond the reach of *b*, then it will be somewhat attracted by it, instead of repelled, unless the charge should rise at once in *a* to near the intensity of *b*. These retarding forces therefore operate to some extent whether the motion is slow or quick, and we perceive how the magnet may fail to receive its full charge when it is moving rapidly. Indeed, the machine or engine not carrying any load may revolve so fast as that the magnet intended to be changed shall not experience any change of polarity, the *back action* being overcome by the momentum of the moving magnet. This element of time required for the maximum development and subsidence of magnetic force, exists, whatever the texture, quality, and size of the magnets. It is influenced and perhaps arises from the action of secondary currents, which we shall explain in our next.

Fig. 1.



C. G. P., *Ed.*

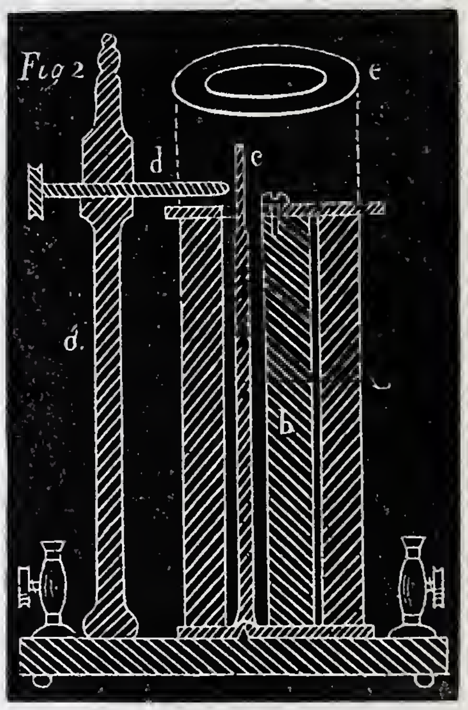
(To be continued.)

ON A NEW ELECTRO-MAGNETIC APPARATUS FOR EQUALIZING MOTION FOR TELEGRAPHIC AND OTHER PURPOSES.

BY PROF. CHARLES G. PAGE, M. D.

This is believed to be the first contrivance in which the varying force of magnetism has been compensated in one and the same electro-magnet. When an armature is presented to an electro-magnet, it is attracted with a force varying inversely as the square of the distance, or, most probably, as the cube of the distance. If this armature is to be connected with machinery, it is necessary to regulate or equalize its force by means of a spring, which of course interferes with the attraction of the armature to the extent of the tension of the spring.

Fig. 2 is a vertical section of the apparatus, which we shall call the *Compensated Armature; a a'* is the helix, which is of an ovoid form in its cross-section, as shown by the extended outline sketch *e*. The opening in the helix is quite oblong, and almost rectangular in shape. When a bar of iron is suspended within a circular opening in a charged helix, the bar tends *towards* the sides or walls of this opening, though this tendency is very feeble. If two iron bars are put into the circular opening, they repel each other, and tend to take positions against the walls of the opening opposite to each other. If the opening in the helix be oblong, then a bar of iron will move with considerable force towards either end of this opening, and if two bars be placed in the opening they will each be impelled from each other by repulsion and also by the peculiar action of the helix, and they will occupy the ends of the oblong opening.



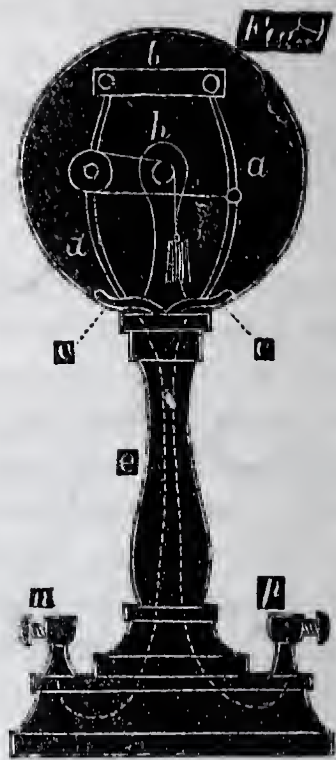
These combined actions are taken advantage of in the *Compensated Armature*. *b* is a bar of soft iron fixed within the oblong opening, and occupying about two-thirds or more of the opening. *c* is another small bar of soft iron, having a small rod of brass inserted in its top, and supported below upon a knife-edge or pivot. *d* is a screw-stem passing through a pillar, and has upon its tapered end a bit of platinum. Opposed to this tip, there is a piece of platinum upon the brass rod *c*. When the electric circuit is completed in the helix, the bar *c* is repelled by the bar *b*, and is also impelled by the helix towards the side *a'*. It is probable that the repulsive action of the magnet and the impelling action of the helix, both obey the same law, and thus give nearly an equal action throughout the motion of the rod *c*. If *c* and *d* are included in an extra or local circuit, as in telegraphing, each time the circuit is made and closed with the helix, *c d* will come together and close the extra circuit. If necessary, a very light spring may be attached so as to bring the armature *c* back against the magnet. The action between *b* and *c* being repulsive, there is no tendency to adhesion between them. This instrument has been tried upon a short telegraphic route and works well. In the instrument used there was no spring used, the bar *c* merely falling back by its own weight, from a slight inclination of the instrument. Prof. Page has made arrangements to apply for letters-patent for this invention, and also for one for the same purpose, and involving the same principle, to be described in our next number.

C. G. P., *Ed.*

ON A NEW THERMO-GALVANOMETER.

BY PROF. CHAS. G. PAGE, M. D.

This instrument, contrived by me some years ago, and made about three years since by Mr. Ari Davis, is designed to measure the quantities of galvanic currents by their heating powers. It is founded upon the principle of Regnier's metalline thermometer, in which the expansion of metallic rods by heat is indicated by means of the curvature of the rods in their middle, both ends being fixed to a frame.



In Fig. 1, *a a*ʹ are two plates of hammered German silver, which metal is selected on account of its low conducting property, and other very suitable qualities. These plates in the instrument are about three inches long, one-twentieth of an inch thick, and one-tenth of an inch wide. For delicate operations they should be made of smaller dimensions every way. The upper ends of these plates enter slight depressions in the cross-bar of brass *b*, which is fastened firmly to a dial plate of brass *d*. The lower ends of the plates *a a*ʹ are fastened to pieces of brass *c c*, which pieces are insulated from each other, and also from the metallic stand *e*. This stand is hollow and the wires represented by dotted lines; within the stand are connected each respectively with the plates *a a*ʹ and the binding screw-cups *p n*. One end of a cord is attached to plate *a*, thence it passes over a little pulley on the plate *a*ʹ, thence over a pulley on the top of the pillar *h*, and to the other dependent end of the cord is attached a small weight. The cord is wrapped twice around the pulley *h*. The axis of this pulley passes through the dial plate *d*, and has attached to it the index hand *m*, as seen in Fig. 2. When the poles of the galvanic battery are connected with the cups *p n* the current passes up the wires within the hollow stand, and through the German-silver plates. As they expand they bend outwardly, raising the cord over the pulleys, and thus move the index. The plates *a a*ʹ should be nearly parallel when not conveying the current, and as they expand they form an arc, the versed sine of which is many times greater than the longitudinal expansion, that is, for a slight increase in the length of the plates there is a very considerable lateral motion at the middle of the plates, which makes it a very sensitive instrument for the purpose.

C. G. P., *Ed.*

TECHNICAL CHEMISTRY.

[Translated for the American Polytechnic Journal.]

ANCIENT ALLOYS.

An extended work has been published by J. A. Phillips respecting the different coins and armor of antiquity, in which he compares their composition with their historical relations, so far as these can be ascertained. It is divided (omitting the historical introduction, which is not pertinent here) into, one part, which treats of the method of analysis, another part respecting the results obtained, and the conclusions drawn.

As to the method, Phillips* previously convinced himself, by means of a common solution, prepared for the purpose, of a quantity by weight of pure silver, tin, silver, lead, and copper, that neither the method given by Pelouze or Levol of determining the copper is sufficiently accurate, because in both cases the influence of atmospheric oxygen, which misleads, is not prevented. He therefore prefers, after the precipitation of the lead by sulphuric acid, and the silver as chloride of silver, to precipitate the copper, with a solution of caustic potash. Instead of weighing the chloride of silver exactly, which appears uncertain, in so small quantities as are proposed on the average for the investigation, he collected it on a filter, and after washing and drying, calcined it, yet without the chloride of silver being melted. The filtrated ashes obtained were immediately wrapped up in a piece of sheet lead with some carbonate of soda, and tartrate of potash, and melted down in a crucible prepared with borax and carbonate of soda, and the pure lead (Bleikornig), containing silver so procured, refined upon the cupel. The quantity of lead must always be large in proportion to the chloride of silver, and of course free from silver, or consist of a definitely known proportion of silver. The proving of this process, with the artificial mixture mentioned, gave for the metals employed, sufficiently accurate results: they were therefore with some modification retained for the cases following. Small quantities of iron, cobalt, and nickel, rendered it frequently necessary first to precipitate the copper, as copper glance (protosulphide of copper), in order then to separate the iron in the filtrated solution by means of benzoate of ammonia, from nickel and cobalt, and these with the hydrocyanite of potash from each other. If there was sulphur present, this precipitated in the developments of the alloy, as sulphate of lead, with the oxide of tin. By digesting the precipitate with carbonate of soda, the sulphuric acid in this can then be carried over, and after the requisite operations with chloride of barium, may be determined. In the absence of lead, the determination of the sulphur is effected directly by an addition of chloride of barium to the filtrated fluid of the oxide of tin. The table B contains the results estimated in 100 parts, and No. 1 to 19 the mean value of the two analyses. Of a number of other coins the proportion of silver only is determined directly by means of cupellation.

* Chem. Soc. Qu. J. N. 252; Edin. Phil. J. lii. 75; Ann. Ch. Pharm. lxxxi. 206; Pharm. Centr. 1852, 101, 115.

TABLE B.

		Obverse.	Reverse.	Color and state	Age.	Weight in grains.	Spec. Weight.	Copper.	Tin.	Lead.	Iron.	Zinc.	Silver.
1	Roman As	head of Janus	a ship	Iron gray at the fracture; blistered	500	4150	8·59	69·69	7·16	21·82	0·47		
2	Half As or Semis	head of Jupiter	S	brittle	500	1997	8·64	62·04	7·66	29·32	0·18		
3	Quadrans	head of Hercules	The sign: OOO	do.	500	970	8.58	72·22	7·19	19·56	0·40		
4	Hiero I.			yellow, shining, compact; very hard.	478	?	8·72	94·15	5·49		0·32		
5	Alexander the Great				335	108	8·69	86·77	12·99				
6	Philip III. Macedon				323	83·3	8·71	90·27	9·43				
7	Philip V.				200	164	8·59	85·15	11·12	2·85	0·42		
8	Athenian Coin	head of Minerva	a naked figure with a thunderbolt	very hard	?	89·5	8·61	88·34	9·95	0·63	0·26		
9	Egyptian do., Ptol. IX.	head with beard	an eagle with a thunderbolt		70	337	8·81	84·25	15·64		trace		
10	Pompejus	head of Janus	bow of a vessel	hard, brittle; cast	53	309	8·70	74·17	8·47	16·15	0·28		
11	Family of the Atilians	do	bow of a vessel, under it Roma	hard, brittle; coined	45	466	9·02	68·69	4·86	25·43	0·11		
12	Julius and Augustus				42	342	8·64	79·13	8·00	12·80	trace		
13	Augustus and Agrippa	2 heads	Crocodile and "COL: NEM"	very hard and brittle; yellow	30	238	8·65	78·45	12·96	8·62	trace		
14	Family of the Cassii			softer than all above named	20	365	8·52	82·26			0·35	17·31	
15	Nero		a sitting Roma	yellowish	60	435	8·59	81·07	1·05			17·81	
16	Titus			yellow, soft	79	178	8·50	83·04			0·50	15·84	
17	Hadrian	Fortunæ reduci		yellow, covered with patina	120	365	8·30	85·67	1·14	1·73	0·74	10·83	
18	Faustina, jr.	Pietas		whitish, brittle, without patina	165	362	8·83	79·15	4·97	9·18	0·23	6·27	
19	City of Samosata		sitting figure of the city	grayish, coarse, brittle, without patina.	212	274	8·53	70·91	6·75	21·96	trace		
20	Victorinus. sen. *a*	Provitentia Aug		tolerably hard, without patina	260	37·7	8·77	95·37	0·99	trace	trace		1·60
21	" " *b*	Salus Aug.		without patina	260	37·6	8.73	97·13	0·10	trace	1·01		1·76
22	Tetrius, sen., *a*				267	37·3		98·50	0·37	trace	0·46		0·76
23	" " *b*				268	45·25		98·00	0·50		0·05		1·15
24	Claudius gothicus, *a*	Spes publica		tolerably hard	268	52·2	8·81	81·60	7·41	8·11			1·86
25	" " *b*	Juna regina			268	58·3	8·71	84·70	3·01	2·67	0·31	trace	7·93
26	Tacitus, *a*	Libertas Augusti			275	66·3	8·72	86·08	3·63	4·87			4·40
27	" *b*	Pax publica			275	49·5	8·70	91·46			2·31		5·92
28	Probus, *a*	Clementia Temp			275	52·2	8·72	90·68	2·00	2·33	0·61	1·39	2·24
29	" *b*	Mars Victor			275	49·0	8·74	94·65	0·45	0·44	0·80		3·22
30	Sword blade, broken	Found in the Thames, under the Chertsey bridge, 17 inches long			Probably they are all from the times before Christ.	1 lb.		89·69	9·58		0·33		
31	" "	Found in Ireland, 8 inches long				4 oz.		85·62	10·02		0·44		
32	" "	do. do. 8½ " "				6 "		91·79	8·17		trace		
33	Lance head, "					11½"		99·71					
34	Battle-axe (Celt)					10 "		90·68	7·43	1·28			
35	" "					1 lb.		90·18	9·81				
36	" "					4 oz.		89.33	9·19		0·33		
37	" "					5¾ "	8·09	83·61	10·79	3·20	0·58		

Remarks.—No. 2 was defective; No. 1, 0·57; No. 2, 0·23; No. 3, 0·28; No. 9 contained traces; No. 38, 0·34 cobalt; also No. 1 traces; No. 2, 0·19; No. 3, 0·20; No. 38, traces of nickel; No. 8, 0·65 cobalt and nickel; Nos. 1, 2, 3, 7, 9, 12, 13, 14, 30, 32, 34, traces; No. 5, 0·6; No. 33, 0·28; No. 36, 0·24, sulphur. The copper in No. 1 has been determined from the difference.

		Inscription.	Weight of the coin in grains.	Contents of silver in per cent.
1	Aurelia	..Restituti Orbis	57·2	2·90
2	"	..Fortuna redux	50·5	2·96
3	Severina	..Providentia Deorum	54·5	4·37
4	"	..Concordia militum ..	54·0	5·80
5	Tacitus	..Libertas Aug.......	61·4	4·90
6	Victorius, sen..	..Pax Aug...........	38·0	2·20
7	" "	..Providentia Aug....	35·7	1·10
8	Tetrius, jun...	..Pietas Aug.........	31·5	0·38
9	" " ...	" "	44·0	0·41
10	Quintillus	..Fides militum......	52·4	2·32
11	"	" "	33·8	2·25
12	Marius	" "	43·7	5·15

According to the results of this analysis and the tables, the older coins are essentially alloys of copper, tin, and lead; but the latter ingredient, with few exceptions, only comes in any considerable amount in the coins before the time of Christ, and often is wholly wanting. Zinc appears as a part of the coin first shortly before the Christian era, and disappears again almost wholly about the time of the thirty tyrants, when its place is supplied by a certain percentage of silver. Of the latter Phillips believes that it was purposely added in order to raise the value, which certainly was not the case with the iron, cobalt, nickel, sulphur, as pure mixtures. The proportion of lead, of the older coins probably, was designed to make the melting easier, as these were cast. As to the later alloys abounding in tin, stamped and yet so hard and brittle, Phillips believes that they were wrought while yet warm under the die or stamp. In no case do the coins consist of unalloyed copper. Even in the pieces of armor examined, there was found only one (No. 33) pure copper; they otherwise consist of copper and tin, nearly in the proportion of 10 to 1, with an addition of lead, which probably served to remedy the too great brittleness of the metal.

R. Hunt analyzed a fragment of a vessel found in an ancient furnace of bronze, probably of Phœnician origin, and which was rusted over the surface, and found—72 per cent. of copper; 9·0 tin; 4·0 iron; 3·0 earthy matters; 12·0 carbonic acid, oxygen, and waste.

ALLOYS OF SILVER COINS.

The proportion of silver in French coins (legally = 0·900) differed in particular pieces about 3·14 thousandth part, as Levol found, and on this account, because the alloy is a mixture of silver, will be in the combination $Ag^3 Cu^4$, which precipitates very easily in an unequal manner. He proposes this combination as the legal alloy (which would thus contain 0·719 silver).

SILVER-PLATING BY MEANS OF COMBINATIONS OF CYANOGEN (CARBURET OF NITROGEN).

By decomposing the ferrocyanate and ferridcyanide of potash with a salt of silver, we obtain, it is well known, solutions which are as well adapted to galvanic plating with silver as the double salt of cyanate of potash with cyanide of silver. Bouilhet undertook the solution of the question, as to what takes place in the mixture of those salts, and whence the property of this mixture for galvanic silver-plating is to be traced.

As to the yellow ferrocyanate of potash, according to the usual prescription for a silvering fluid, dissolve it in six parts of water, and add some-

what more than one-tenth of its weight of chloride of silver. Since the ferrocyanate of potash exists in it in such excess that the pure exhibition of the combination of silver formed could not be obtained, Bouilhet substituted a more simple recipe by boiling for an hour a solution of one part of ferrocyanate of potash with 8 parts of cyanide of silver. This formed a dirty blue sediment; the fluid filtrated from it was colorless, now was an alkaline reagent (which before was not the case) produced under the influence of the galvanic currents a plating of silver, showed itself free from iron, and by crystallization yielded a salt consisting of cyanogen, silver, and potash. For the purpose of quantitative analysis, Bouilhet converted a quantity by weight of it into sulphates, and determined the weight of the same in a red-hot state (a particular experiment had taught that there would be no loss in it), as well as the proportion of silver and sulphuric acid. The value thus obtained, as well as the determination of the cyanogen, by burning another portion of the salt with chromate of lead, produced the proportion in equivalents of $2\,Cy + Ag + K$. In order to examine the sediment more closely, the exhibition of the silvering fluid was repeated in a particular apparatus with the exclusion of the air. The sediment now appeared gray, and on exposure to the air or by means of chlorine, took a blue color, and became a cyanuret of iron. Bouilhet therefore concludes that the adaptedness of the fluid in question to plating with silver, is owing not to the iron being fully eliminated from the solution, but absolutely to the formation of the double combination $Cy\,Ag, Cy\,K$, which he thus explains: in the bringing together of the ferrocyanite of potash with the cyanide of silver, the cyanite of potash is immediately found (hence the introduction of the alkaline reaction), and also ferrocyanide of silver, which in boiling decomposes into one equal part of cyanuret of iron and two equal parts of cyanide of silver; the latter combines with cyanide of potash formed at the beginning into a double salt $= Cy\,Ag, Cy\,K$. If any one chooses to employ, instead of the cyanide of silver, as in the original recipe, some other salt of silver, as for example chloride of silver, then (in place of cyanate of potash) there is formed chlorate of potash and cyanide of silver, which reacts on the residuum of the ferrocyanate of potash as before. Synthetic experiments, which were instituted for the confirmation of this explanation, gave for a definite weight of materials the amount of double salts nearly, which is shown by the theory, provided that the boiling is carried on at least three hours, by which the sediment gradually takes a red color.

If a solution of ferridcyanide of potash be decomposed with cyanide of silver in the same proportions as in the ferrocyanate of potash, there is immediately formed a blue deposit which at last by continued boiling becomes red, while the fluid itself is perfectly colorless. When filtered it shows the same properties as those exhibited in the case of the ferrocyanate of potash; it plates in the galvanic apparatus, is free from iron, and contains a salt which, analyzed according to the method described, appears as $Cy\,Ag, Cy\,K$. When the process was made with the exclusion of the air, the deposite was not blue but brown, but gradually passed into red, with the extrication of the cyanuretted hydrogen, and then exhibited the properties of an oxide of iron. It is also properly a cyanide of iron, which is decomposed afterwards under the influence of the boiling heat and the water. From the products formed (cyanide of silver, cyanide potassium, hydrocyanic acid, and cyanide of iron), Bouilhet draws the conclusion, that the connection of the process is wholly analogous to that of the decomposition of the ferrocyanate of potash by means of cyanide of silver; there is therefore first formed from

the ferridcyanide of potash and cyanide of silver, ferridcyanide of silver and cyanide of potassium; the first is decomposed into cyanide of iron and cyanide of silver, which then combine with the cyanate of potash. By the use of another salt of silver (for instance, chloride of silver), there is formed ferridcyanide of silver and a corresponding salt of potash (chloride of potash), whereupon the same reaction as before takes place. In this case also the synthetic confirmatory experiments gave nearly the quantity of double salt estimated by theory, and the same of the latter with the simultaneously formed deposit (when this is taken into the account as cyanide of iron, after an analysis made at the close), very nearly the weight of the ingredients used.

Pure cyanide of silver (exhibited by means of the introduction of hydrocyanic acid in a weak solution of nitrate of silver), boiled with cyanide of potash, yielded a salt, which in the analysis proves to be double salt Cy Ag, Cy K. In similar circumstances, in the galvanic apparatus, it yields nearly as much silver as the other two fluids for silver plating. Bouilhet concludes his investigation by stating that whichever of them may be used, the double salt named is the only true agent in the silver-plating.

COATING OF ZINC WITH OTHER METALS.

Lüdersdorff engaged in the investigation of the ways and means of discovering a mode of coloring articles of zinc with other metals, and particularly the chemical method by simple immersion or rubbing on. As a steep for the restoration of the pure metallic surface, he finds for small articles, which can be dipped in, that a mixture of two parts of concentrated nitric acid and one part of sulphuric acid is the most suitable; for larger articles, as for instance statues, they are to be washed with a solution of potash and ammonia. For coating with the metals under consideration, he proposes it be done by means in part of tartrates (for zinc, copper, bronze), partly by cyanide of potash (for gold and silver). In reference to the recipes for the various solutions, and the necessary manipulation, we refer to the treatise itself.

METALLIC COATINGS GENERALLY.

Prescriptions for the galvanic coating of metals with brass, are given by Heeren; and Steele, those for fluids for galvanic bronzing, tinning, copper-plating, plating with silver and gilding with the well-known agents; while Grissel and Redwood give those for other metals in the usual way.

COATINGS OF IRIDESCENT COLORS.

According to Bergeat thin coatings of iridescent colors may be obtained on bronze and brass in the galvanic method, if the article be brought into connection with the carbon end of a Bunsen's battery, and it be dipped into a lye of 500 grammes of caustic potash with one quart of water, which has first been boiled with litharge. On closing the circuit the color takes place, and runs through gold-yellow, orange, red, into blue and green. According to Geubel, one might obtain such coatings on sheet-copper, if sulphuretted hydrogen is applied to its surface, when it has been moistened with muriatic acid.

SALTS: POTASH.

Bley finds, in the Illyrian potash lately again brought into market, after it has been unknown there for some years; in two specimens, for the 100 parts:

Carbonate of potash	78·75	82·85
Carbonate and sulphate of soda	12·50	12·50
Silicious earth and gypsum	8·75	4·65

Gatty has obtained a patent for combining the manufacture of tartaric acid with carbonate of potash. He uses for this the neutral tartrate of potash, which continues in solution after the saturation of the tartaric acid with chalk. According to the specification of the patent, this solution must be mixed with the requisite quantity of milk of lime, and after the transposition has taken place carbonic acid gas be conducted through it. The fluid, which at the end of the process contains carbonate of potash, must be drawn off clear from the tartrate of lime, evaporated, and the residuum calcined.

VAREC OR KELP.

Golfier-Besseyre has investigated a variety of kelps obtained on the French coast. He made use with a few modifications of the methods given by Gay-Lussac, by lixiviation, as well as the thermometrical analysis for determining the proportion of salts of potassa to the salts of soda. Thirty-four sorts collectively in the treatment with water left an insoluble residuum or very difficult to dissolve in it, consisting of sand and earthy salts. The proportion of the soluble salts to this residuum varied between the two extremes 20·5 : 79·5, and 72·5 : 27·5, it was therefore between $\frac{1}{5}$ and $\frac{8}{11}$ of the whole. The dissolved part, which alone was closely examined, consisted of salts of potash and of salts of soda, in very fluctuating proportions, and according to the classification of bases and acids chosen by Golfier-Besseyre within the following limits: the sulphate of potash varied from 44 to 11 per cent. (the sum of the soluble salts), and sank even in one case to 2 per cent.; the chloride of potash from 35 to 12 per cent. even to 0·36; the iodide of potash reached only to the hundredth of a per cent.; the chloride of soda varied from 70 to 9 per cent.; the carbonate of soda, which in such products stands in the background, from 17 to 9 per cent., and sometimes was altogether wanting; the sulphate of soda was mostly wholly wanting, yet once reached to the height of from 18 even to 35 per cent.; and likewise the hyposulphite of soda as an exception reached to 20 per cent., but mostly was wholly wanting.

MARINE SALT.

Schrotter and Pohl analyzed two kinds of sea salt found in commerce, one of which was from the salt-yard of St. Felice, in Venice (*a*), the other from that of Trapani, in Sicily (*b*). Both kinds dissolved in water left a residuum consisting of lime, alumina, oxide of iron, magnesia, phosphoric acid, carbonic acid, and quartz sand; the filtered solution proved to be free from carbonates, from combinations with fluorine, phosphates, bromine, and iodine. The analysis gave in 100 parts of the salt mixture contained in the solution:

	(*a*)	(*b*)
Chloride of soda	95·91	96·35
Chloride of magnesia	0·46	0·50
Sulphate of soda	0·40	0·51
Sulphate of lime	0·49	0·45
Insoluble residuum	0·16	0·07
Water	2·58	2·12

SALTPETRE.

According to Gentele, for the purposes of manufacturing nitrate of potash from nitrate of soda, a person must pour a solution of the latter into a boil-

ing solution of as much potash. There is deposited a carbonate of soda, which must be drained out. The remainder of the soda may then be separated from the saltpetre by reducing it to powder.

As to the presence and profit of saltpetre in Hungary, Szabo and J. Moser have made communications. On the examination of crude saltpetre, see the report for this year, page 627.

SOAP.

In reference to the preparation of soap, with an addition of starch, which is regarded as necessary in many soaps for the toilet, but in the common soap in bars is considered an adulteration, Pohl states that a soap of this kind for some time has been found in trade at Vienna, and which may be prepared in the so-called cold method by stirring in it from 6 to 10 pounds of starch, 40 to 50 pounds of tallow, and 100 pounds of soda (made with 110 pounds of lime, to a caustic lye of 18° Beaume). The product feels elastic, is quite white when cut, entirely homogeneous, and is wood-brown when dried. The starch in it may be indicated by iodine. One specimen gave, 53·82 per cent. of fatty acids, 6·31 of not perfectly pure starch, 36·41 of water, and 3·60 of soda and waste.

MORTAR AND HYDRAULIC LIME.

Schafhäutl, in a contribution to the history of cements or hydraulic mortars in England, gives a series of historical and technical notices, especially respecting Roman Cement, Portland Cement, and the so-called Concrete, as to which we refer to the treatise.

In an appendix respecting the shining stucco of the ancients, Schafhäutl seeks to supply the chasms in the theory of the stiffness of the mortar, by hints in which he intimates that there is between fluidity and solidity a third or middle condition, which is available in the phenomena mentioned, as well as in the geological, but is yet much too little noticed. The chemistry for this middle state, the "*Straitochemie*" as opposed to "*Hygrochemie*," the doctrine of combinations of soft bodies, must first be established.

Schafhäutl incidentally mentions, in the treatise referred to, an analysis conducted by him of the Sheppey Stones, *i. e.* nodules of lime (*a*) found in the Isle of Sheppey, which serve for the Roman (Parker's) cement. Pohl analyzed an hydraulic lime (*b*) of Sievering, near Vienna. The analyses gave for 100 parts, especially for that with muriatic acid,

SOLUBLE PARTS.	(*a*)	(*b*)	INSOLUBLE PARTS.	(*a*)	(*b*)
Carbonate of lime	67·12	48·36	Silicious earth	16·51	30·98
Carbonate of magnesia	1·33	2·50	Alumina	4·20	1·72
Protocarbonate of iron	5·50	3·50	Oxide of iron	1·03	trace
Protocarbonate of manganese	1·35	trace	Oxide of manganese	0·61	trace
Alumina	0·41	10·31	Lime		0·80
Sulphate of lime		trace	Magnesia	0·41	
Phosphate of lime		trace	Sulphate of lime		trace
			Potash with traces of Soda	0·88	
	75·91	64·67	Bitumen		1·47
				23·64	34·97

La Roche found in an hydraulic lime belonging to the lias formation, and quarried at Wiesloch, used among others for the building the harbor in Manheim, by two analyses the results (*a*) and (*b*). Adler, in a powder bought as Portland cement, the result (*c*):

	(a)	(b)	(c)
Lime	42	44·0	48·16
Oxide of iron	3	3·0	12·00
Alumina	12	10·5	3·12
Silex	4	4·3	27·00
Carbonic Acid	35	36·0	7·66
Moisture and Waste	4	2·2	
Sulphuric Acid			2·06
	100	100·0	100·00

Marignac examined two specimens of hydraulic lime from the Drance:

Carbonate of lime	50·25	50·36
Carbonate of magnesia	40·95	41·99
Clay	8·17	7·05
Water	0·92	0·37
	100·29	99·77

WHITE LEAD.

The kinds of white lead analyzed by J. A. Phillips, as already mentioned in p. 357 of this Report, according to the Dutch method, did not always exhibit the same condition. The usually good and successful product was hard and firm (*a*), yet here the white lead was obtained in some pots, soft and spongy, and easily crumbled between the fingers (*b*). As the subsequent analyses of Phillips proved, this is not owing to the difference of composition, yet there were among them certain kinds (as *c*) which varied from the usual compound.

Name of the White Lead.	Carbonic Acid.	Oxide of Lead.	Water.	
W. Blackett's	11·26	86·51	2·23	(a)
Darlington's	11·62	86·36	2·05	
W. Blackett's	11·58	86·11	2·34	(b)
Darlington's	11·53	86·27	2·21	
W. Blackett's	12·58	85·52	1·58	(c)

All the five sorts were wholly free from acetate of lead. If these products agree with Mulder's, yet on the other hand they differ from those of Richardson. Phillips supposes the reason to be in the too great degree of heat in which the latter dried the white lead, for by means of the experiments instituted, it lost at 150° all the water in combination, and at 170° the carbonic acid.

CHROMATES.

According to Swindell, the extrication of chromates from chromate ores by heating red-hot the pulverized ore with common salt, chloride of potash, or hydrate of lime (according as the manufacture is of salts of soda, potash, or lime), must be undertaken in the commencing glow of white heat, in a reverbatory furnace, while a stream of very hot vapor is conducted over the mixture, which must be often stirred up.

LIME BLUE.

Gentele examined a blue calcareous oxide of copper (containing lime), which is to be found in commerce under the name of Lime Blue. A less beautiful species of lime blue is obtained from the precipitation of sulphate of copper in a very thin milk of lime in excess, and set in the cold. The more beautiful kind examined in preference by Gentele is obtained by the precipitation of a solution of 100 parts of sulphate of copper and 12½ parts of sal-ammoniac, by means of milk of lime, of 30 parts of burnt lime, in the cold. The fluid after some days becomes perfectly colorless. A solution

of blue vitriol, mixed with an excess of ammonia and dropped into lime water, gives the same precipitate (*a*), which decomposes in washing, and becomes soluble in ammonia. If we drop lime water, or milk of lime, into an ammoniacal solution of copper, there also appears a blue precipitation, which in the beginning again dissolves; if milk of lime be added to it, until it begins to be permanent, and then it is immediately filtered, the fluid yields elegant blue needle-shaped crystals (*b*). With a sufficient addition of lime the fluid is likewise wholly colorless. The analyses gave:

	(*a*)	(*b*)	
Water	18·76	26·01	27·00
Sulphuric acid	11·20	23·83	
Oxide of copper	46·85	33·56	33·44
Lime	16·19	16·19	
Waste (Carbonic acid)	7·00		
	100·00	99·59	

Gentele estimates from (*b*) the formula, $5(CaO, SO^3. 2HO) + 7(CuO, 2HO)$; the analyses likewise agree as well with the more simple proportion 2 : 3 of the two members, and hence he constructs a recipe for its preparation. When sulphate of ammoniacal oxide of copper is digested with sulphate of lime there is no such deposit. Potash and soda used in place of lime produced deposits of another kind as might be expected. The presence of ammonia makes the hydrated oxide of copper far more certain, and renders the exhibition easier.

COLORS IN OLD PAINTINGS.

Dumas and Persoz have investigated the chemical nature of the substances used in old paintings of the 13th century, on the wall of the Sainte Chapelle at Paris. The painting is on a gold ground, the gold ground being laid on a coating resembling varnish (this consists of 81 per cent. of oxide of lead, and 19 of fatty acids), the upper layer of which is colored red with red lead. The white of the painting proved to be a preparation of lead soluble in acetic acid (probably white lead), a kind of blue was recognized as a phosphate of iron, another blue as ultramarine, a deep red as cinnabar, brown as well as yellow as ochre. The rose in some flowers appeared at first to be lake of madder, but probably was identical with the color which is obtained by pulverizing a rose-red muscle (*Tellina fragilis*) that abounds on the coasts of France; a violet similarly circumstanced resembled also the powder of the violet portions of the shells of the *Neritina fluviatilis*. These colors, the Report concludes, were not oil colors ground with varnish, but appear the rather to have been put on dry by dusting over the surface smeared with varnish, just as certain earthenware is glazed.

PREPARATION OF GLASS—CLOUDING OF GLASS.

Splitzgerber makes the observation that many kinds of glass by moderate heating in the spirit flame become clouded, cracked, and rough, but only on the surface. It is evident that this is a sign of poor glass, melted with too much alkali or too little lime, which on this account becomes more or less affected by a drop of melted chloride of lime smeared over it. This clouding and becoming cracked is caused by the expulsion of the moisture combined with the upper surface of the glass, and depends on a yet invisible decay from the influence of the atmosphere. One piece of such glass yielded him $\frac{1}{6}$ per cent., another 1 per cent. of water by heating. When the clouded surface of a glass is polished off, the new surface no longer exhibits the appearance.

ON THE WORKING OF WOOD.

A historical sketch of the devices employed in working in wood, including sawing, planing, turning, boring, mortising, carving, and other ornamental work.

It has been said that the history of the progress of civilization would be recorded, if the history of the invention of some early and useful tool could be written: fanciful as this may seem, there is undoubtedly a near association between the progress of the mental development and culture of man, and that of the mechanic arts; this was noticed and commented on by very early writers, and has often been repeated in modern times: no such history has, or can be written; in fact, a written language is itself an indication of so high an advance in art, that all the earlier epochs are buried in the clouds of dim tradition, and the seal of uncertainty and oblivion has been placed upon them.

No material has so much or so long engaged the thought and skill of man as the working and fashioning of wood for his wants and purposes; it was his earliest aid probably in the first stages of his progress, and has maintained its predominant position in supplying his wants, comforts, and luxuries up to the present moment, and in the highest stages of civilization. To enumerate the purposes to which it is, or has been applied, would require volumes; and a detail of the machinery devised for working it would fill a library. In bringing to the notice of our readers some of the prominent manufactures of wood, and the machines employed therefor, we shall confine ourselves principally to the improvements of the last two or three centuries, and to those lines of manufacture which have been, or may be, usefully introduced into this country.

The first important use of wood by man was the formation of habitations, either in part or whole of that material, the gradual advance from the tent-pole of the nomadic tribes to the more permanent habitations formed wholly of wood, solid and durable, form a continuous series in the progress of man, from rudest barbarism to civilization: the hut of logs is the rudiment of the coming town, the collection of a family under one roof the nucleus of future society. The log hut of the pioneer on the outskirts of civilization requires but few tools; the woodman's axe will do all for its construction in its rudest form; if doors of thin material be wanted, the addition of a saw is an aid; if any part is framed, chisels or their equivalent are required; by placing these chisels in a stock planes are formed, with which the surface of the finer parts can be smoothed. With the aid of these tools and some others, devised by the advancing refinement and increasing wants of cultivated man, more seemly works are accomplished—by saws, hammers, nails, and the like, beautiful edifices arise, tasteful and comfortable; the wainscot of the walls becomes highly elaborated; carvings and ornaments adorn the balustrades and hand-rails; mouldings are made to give a finish and beauty to the structure, showing the progress of taste and wealth, and wondrous skill and labor. This does not wholly satisfy; the labor required for the production cannot be requited; easier modes must be devised, and labor-saving machinery is suggested, and implements for making elaborate ornaments more regular and more speedily than could be done by hand are constructed—these we shall try to trace, not from their inception, but from the earlier and ruder forms to the present more perfect organization.

The most difficult and laborious operation is to reduce a log to one or more large flat surfaces, such as squared timber, or slabs in the form of

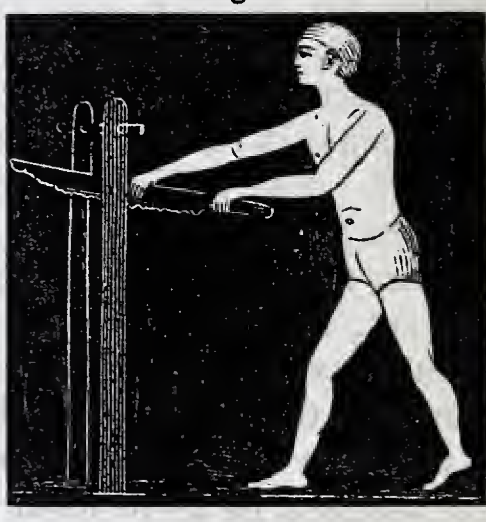
planks and boards; this was first done by splitting and hewing—next by sawing. And this implement, the saw, shall first engage our attention, as one of the most primitive as well as useful tools to which other than manual labor was applied, or of which an organized machine was formed for the working of wood.

Saws were known to the ancients. One has been discovered in a private tomb at Thebes, together with some other carpenters' tools, and is now preserved in the British Museum; the blade is ten inches and a half long, and one inch and a quarter broad at the widest part; the teeth are irregular, and seem to have been formed by a cutting instrument struck against the edge of the plate, thus raising a sort of tooth or burr. The following is a representation of this curious old relic.

Fig. 1.

In Rosellini's work on the antiquities of Egypt are several representations of the saw and its uses; the one which we have given a copy of is taken from an Egyptian painting: a man is represented in the act of sawing; the teeth of the saw are tolerably well formed, and altogether it is a creditable implement, not unlike the handsaw, except the handle, which in this instance is straight, like a modern key-hole saw. The Egyptian saw seems to have been made of brass, like many other tools of that wonderful people.

Fig. 2.



Among the ruins of Herculaneum a curious picture has been discovered, representing the interior of a carpenter's shop, in which are two figures engaged in cutting a piece of wood with a frame-saw. In the bench on which the wood is laid there are a number of holes, into which the cramps that hold the wood are put; these also are similar to those of modern times. This is the earliest representation within our knowledge of a frame-saw for two persons. A frame-saw is shown upon an altar in the *Musé Capitolin* at Rome, with the frame and twisted cord for tightening the saw quite like a modern implement of the same kind.

The commonest saws now sold in the market are, according to Hebert, made of plate-iron, hammer-hardened, and planished upon an anvil, to give them a degree of stiffness and elasticity: such instruments are, however, nearly worthless. The better kinds of saws are made of shear or cast-steel. In the English manufactories, after the steel is rolled out into plates and cut into form by shears the edges are filed, and then, by a clumsy and unmechanical process of manual labor of the most disagreeable and fatiguing character, these flat surfaces are slowly ground level on a grindstone; some skill, and great physical power are required in this operation. Next, the teeth are cut in a fly-press, or more expeditiously by a die-cutter moved by steam. After the teeth are cut and trimmed the plates are hardened and tempered; the saws are then planished and submitted to a grinding process, as before spoken of, upon a large grindstone. The plate is held against the circular face of the stone by an interposing board, against which the grinder presses with all his force. In order to grind it as evenly as possible the workman stands on tiptoes, stretching over the stone, which revolves with great rapidity; his hands, arms, breast, and knees, being all brought into action to produce the desired effect, while he becomes wet and covered with the debris formed by the operation. This primitive manipulation is superseded in this country by a grinding machine, which does the work better and much more expeditiously. The process of grinding impairs the

flatness and elasticity of the saw-plates, and they are consequently hammered again. A substitute for this last process has been invented in the United States, and recently patented, by which the saw-plate, when properly heated, is struck by a very heavy iron casting or hammer, covering the whole surface, and bringing the plate down upon an anvil of equal size, thus finishing the operation at a single blow. We are not aware that sufficient experience has yet been had to determine the value of this device, but it certainly shortens the time required to manufacture the saw. The hammer marks made by small hammers are taken out by passing the plate lightly over a grindstone, and then polishing on a buff-wheel with emery.

To make the surfaces of saws truer than by grinding, Gen. Bentham, in his patent of 1793, proposes to stretch them upon a proper bed or support, and by a reciprocating motion their whole surface is brought under a cutting tool. This would seem to be the first iron-planing machine described.

Returning from this digression upon the manufacture of the plate, we are next to notice the teeth, and the varieties in their forms which have been from time to time adopted, according to the skill and knowledge of the mechanic, and the purpose for which the saw was intended, the fancy of the constructor, or inventor; often without any true understanding of the requirements of the tool, or power of adapting it to the work to be performed. The following are among the most prominent varieties of forms of modern saw-teeth. A is a hand-saw tooth; in this, as in most of the others, the teeth are set, or bent alternately to opposite sides, beyond the face of the plate, as shown in the plan. In filing these teeth to sharpen them their outer edges are left the longest, so as to form an obtuse cutter, as shown at a; the front side of the tooth is perpendicular, and the rear side inclined more or less: this seems to be the oldest form of tooth, and is commonly called the hand-saw tooth. It is filed so that the face b of every other tooth shall be in a line parallel with the line a; the others are at an opposite angle, parallel with the line h. The purpose of this saw is generally to rip or split planks lengthwise of their fibres, and it is required to cut very little on either side; but it will be perceived that the greatest amount of cutting edge is at the side, and very little if any true cutting surface is left at the upper edge or point of the tooth; the consequence is, the operation is one of abrasion, and not, properly speaking, cutting, and so far the tool is ill adapted to the service. A saw so formed is rarely ever perfectly set; and if it is not, the work done by the teeth will be very unequal. Those teeth that are set the widest perform an undue share of the work, are soonest dulled, and cause the rough, uneven surface upon the face of the kerf, so well known to workmen: these irregularities of course increase the labor. When critically examined, the ordinary saw will be found the most incorrectly constructed tool of modern times. For cross cutting, the side edge is useful; but as the only part that cuts is the extreme point, which is set outward, the operation may be termed scratching rather than cutting. Many difficulties present themselves in changing the character of this tool, and so far it seems to have defied the ingenuity of man to radically improve it. B in the diagram is the *peg*, or *fleam*-tooth, and is used in cutting both ways; it is a very stout and durable tooth, but is subject to most of the objections of that first named. The *cross-cut tooth* C is like the peg-tooth,

Fig 3.

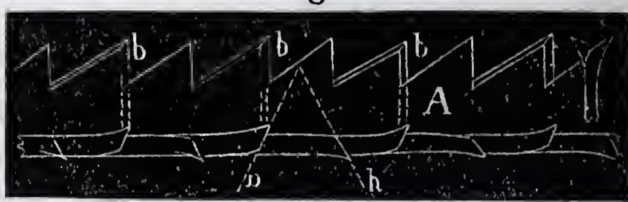


Fig. 4.

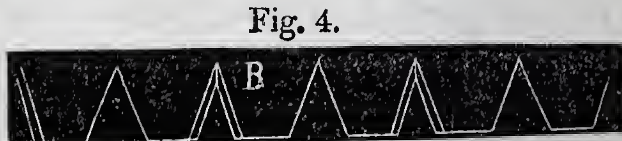
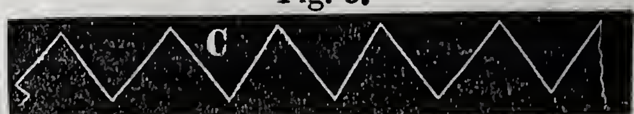


Fig. 5.



but there is no straight space between the teeth. These last are generally used with two men, one at either end of the saw, as in pit-sawing. D represents gullet or brier-teeth, in which, in addition to the two inclined lines that form the point of the tooth, there is a deep rounded notch cut out at the base in front of the tooth, forming what is technically termed a gullet; this enlargement is for the purpose of holding a greater quantity of shavings or sawdust than the obtuse angle of the tooth would admit; and also to allow the tooth to be sharpened with a flat or half-round file;—this tooth is generally set in the same way as those before named, its only advantage is, that the tooth is stouter. Sometimes saws are made materially thicker on the toothed edge than on the back, as in pruning saws for green wood, shown in diagram E. And it has been attempted to spread the points of saw teeth for cutting wood as at F, in the same manner as saws used by smiths in sawing metal, but they were found to anchor in the wood, and on the whole were unserviceable.

Fig. 6.

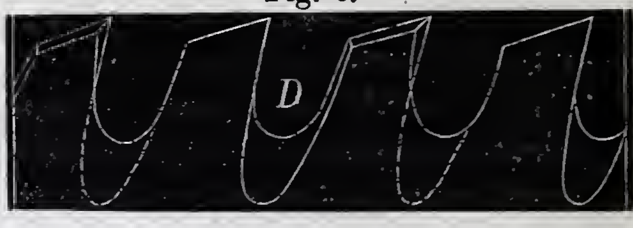
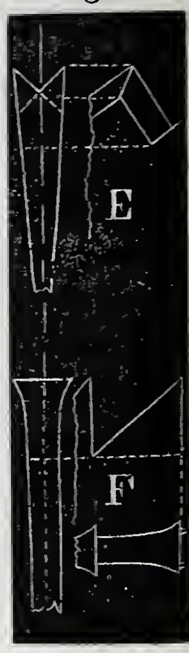
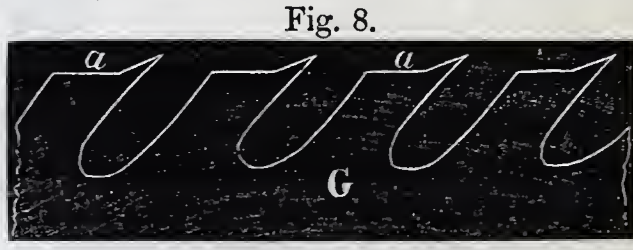


Fig. 7.



A recently patented improvement in ripping saws, whether for cutting plank, resawing or slitting, seems to promise a valuable advance in the improvement of saws, and may lead to many others, we therefore describe it more particularly. The newly invented tooth, Fig. G, is in its general characteristics like the gullet-tooth; but instead of the back of the tooth *a* being formed at an angle, as all the gullet-teeth heretofore made have been, the back inclines a little distance from the edge *b* of the tooth, and then extends back in a line parallel with the cutting edges;—the cutting edges themselves are spread, as shown at diagram F; the teeth are filed sharp, and then finished by passing a file lightly over the face of the whole to straighten them, and turn their cutting edges into an exact line with the course of the saw in cutting. Saws made on this plan for hand or mill purposes, have been found to perform nearly double the work, with a given force employed, to what could be effected by saws of ordinary shape. It is obvious that these saws are not adapted to cross cutting; but they seem to leave but little to be desired in ripping or similar work, where the cut is to be made lengthwise of the fibre. The advantage of the straight breast *a* on this tooth is to prevent the tooth from anchoring in the wood. It can only enter as far as the breast, and is then made to cut like a plane, bearing upon the straight portion of the tooth; the action is like that of a series of narrow planes, it cuts instead of scraping or abrading the fibres, which renders the work easier, and causes the saw to last longer.* There are many other intermediate forms of teeth besides those figured, but we do not propose to go into minute details. It has been attempted to use plane-cutters on the sides of saws, to plane the material as it is cut, and curved teeth have been made in very early times, hooking alternately in opposite directions, so as to cut either way; but these devices have proved more fanciful than useful: and when originally discovered, were soon abandoned and

Fig. 8.

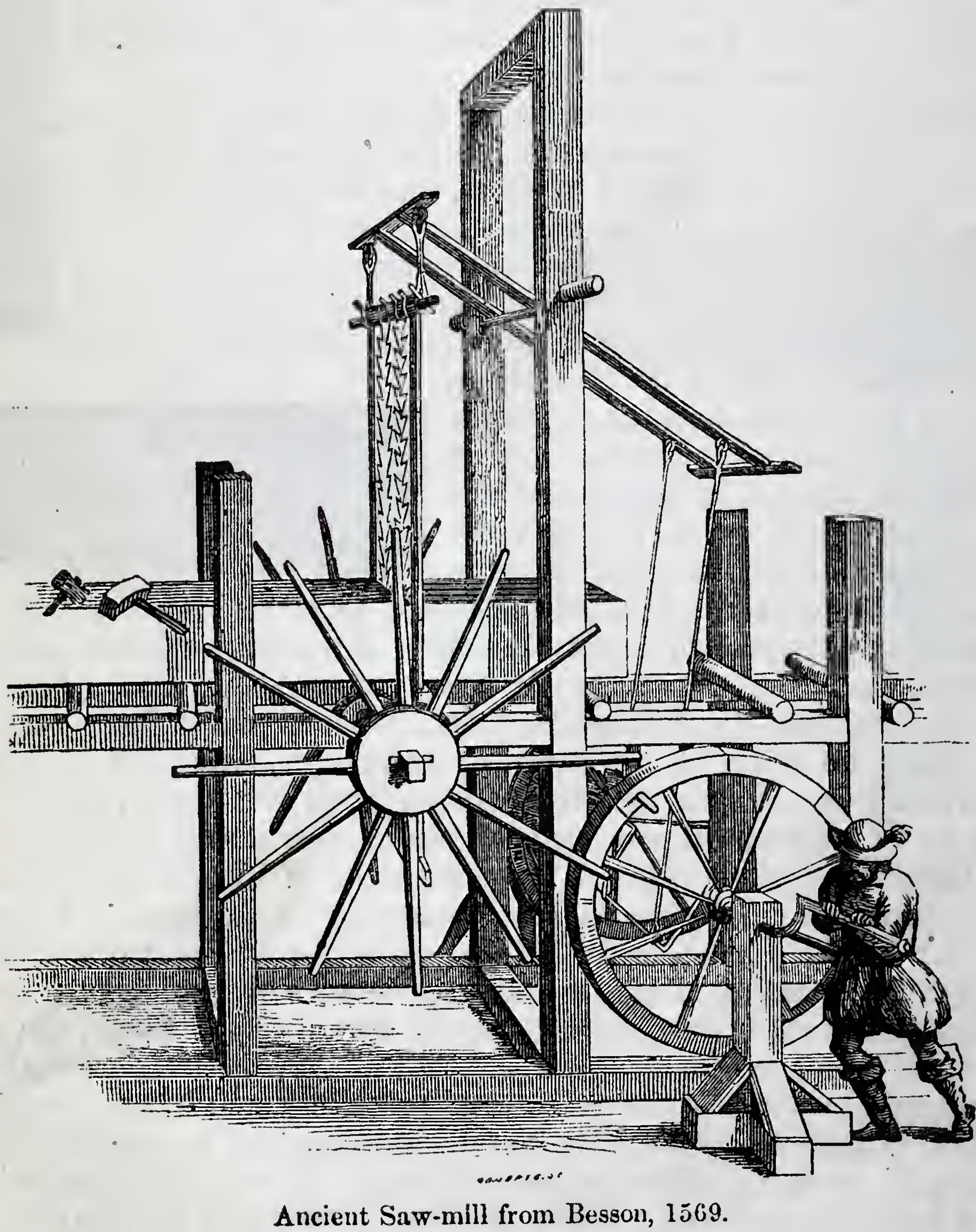


* This ingenious and simple invention is patented by H. Knowles, Esq., late machinist of the Patent Office.

forgotten till resuscitated by some subsequent inventor, to be again consigned to oblivion.

Saw-mills are of great antiquity. In the fourth century a saw-mill was erected on the river Roeur, in Germany: this was probably but a rude and primitive effort, for at a much later date they were considered as new and uncommon. Upon the discovery of Madeira, in 1420, mills were there erected for sawing the excellent timber of that island into planks, showing that saw-mills were well known at that date. About the same time the cities of Breslaw and Erfurt had saw-mills; but a knowledge of them was not universally diffused, for the Bishop of Ely, ambassador of Queen Mary to Rome about 1555, particularly describes a saw-mill he then saw for the first time. They were not introduced into England till the eighteenth century.

Saw-mills were in early times devised to work by manual labor as well as by water, and to this machine many of the crude devices for saving



Ancient Saw-mill from Besson, 1569.

labor, or multiplying or increasing power, were applied. In a rare old work, *Theatrum Instrumentum et Machinarum*, by J. Besson, in 1569, there is a representation of a saw-mill, here copied, in which there is a gang of saws, one half of which saws have their teeth formed to cut on the

downward stroke, while the intermediate ones are formed to cut on the upward stroke. The device for hanging and vibrating the saw is ingenious for the employment of manual power: and the log is fed forward by means of a windlass and cord on rollers, the windlass having arms extending out from it which are struck by a pin on the fly-wheel upon the crank shaft, that turns the windlass at intervals, by which the log is moved a given distance at every revolution of the crank. In the next engraving of the same volume there is another saw-mill, with a singular form given to the teeth, as more clearly represented in the separate diagram H, in which it will be seen that every alternate tooth hooks one way, while the intermediate ones hook in the opposite direction; or rather, there are two hooked cutters on each tooth, whose points turn in opposite directions, for the purpose of cutting as well on the upward as the downward stroke of the saw. It will thus be seen, that at this early period gangs of saws were known and used;—and in fact, all the elements were known for feeding in the log and sawing by power as early as 1588, as shown in Ramelli *Le Diverse et Artificiose Machine*, published in that year.

Fig. 10.

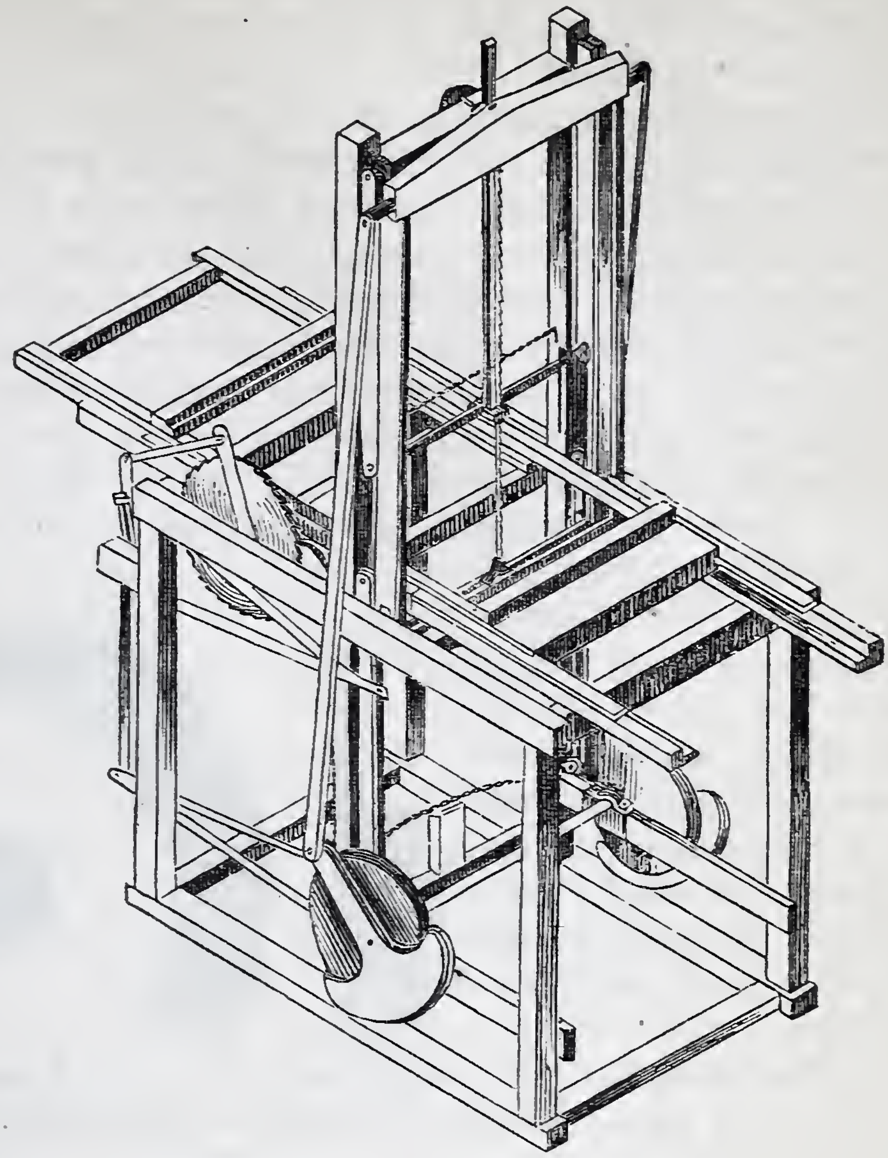
In modern times most of the improvements in saw-mills have been confined to setting the log, guiding and supporting it, and guiding the saw and straining it in the gate, or dispensing with the gate, or guiding the same; for many of which patents have been taken.

When one saw only is used in sawing a log up into planks, each time the saw runs through the log, the log itself must move sideways far enough to permit the saw to cut the next plank, or else the saw must be moved; the latter has been suggested, but never to our knowledge successfully put in practice. The log lays upon a carriage, moving lengthwise on proper rails or other fixtures, supported by head and tail blocks, one at each end; and sometimes, when the log is very long, intermediate supports are temporarily applied; and generally a roller or other fixture is situated near the saw, to resist the force of the cut. To set the log, the parts of the head and tail blocks to which the log is dogged or fastened, have a lateral motion given them either by hand, or by some contrivance by which they are rendered self-acting; the object is to throw the log quickly and accurately to one side, without passing the proper point. The devices for this purpose have been screws, racks, and pinions or pawls, put in motion by stationary projections, against which the part to be moved strikes just before the carriage is quite run back to the point from which it commences its next forward movement.

For guiding balks of timber, Bentham, in his patent of 1793, says: "If the piece in sawing is liable to be bent laterally out of its direction, this effect may be counteracted by rollers stationed just before the teeth of the saw, so as by a spring or weight to press against the side of the piece, and keep it to its direction." He further says: "To confine the saw the better to its direction, and prevent its being twisted by any cause, I sometimes employ a pair of guides, consisting of pieces of hard wood, or metal, having each of them a slit, in which the saw itself is moved, and by the sides of which the whole breadth of the saw, the teeth only excepted, is embraced. One of these guides is fixed as near as possible above the upper surface of the piece, the other as near as possible below the under surface. To cut a curve you need only to make the piece advance [to the saw] in a direction adapted to such curve. In cutting circularwise (in cutting felloes of wheels for exam-

ple) the business of directing the course of the piece may be performed by a pair of calipers lying flat on the bench or floor, and moving about a centre; which calipers are, at their extremities, furnished with teeth proper for laying hold of the ends of the piece: the arms of these calipers must be of a length equal at least to the radius of the circle to be cut. The operation of advancing may, in this case, be performed in the same manner as that of rectilineal sawing, except the rack, instead of being straight, must be bent to the segment of a circle, and fixed concentrically to the calipers. Pieces may be cut to an elliptical form by substituting an oval trammel instead of calipers." A piece may be cut to any irregular curve by forming a channel in the bench to the curve required, over which the piece to be cut slides; then by inserting pins in the piece (or its carriage), it is moved according to the curve to be cut. To saw beveling and winding surfaces Bentham proposed the following apparatus:—Let the frame or bench on which the piece moves be made to tilt or turn on a pin or gudgeon at each end, so placed that if joined they would form an axis passing lengthwise through the middle of the bench, at the height of the upper surface of whatever is used to support the piece, and through the saw. On one side of this axis let the bench be loaded, in such a manner that it would drop on that side if it had no support. From the under part of this side project a support downwards, then place below a waved-mould or director, by which the bench is canted according to the winding surface required.

It has been attempted to move the saw along the length of the log, instead of moving the log up to the saw, but this has not been found to work well in practice: great steadiness and accuracy of motion is required in the saw to produce the best effect, which has been found incompatible with carrying it along the log. In hanging the saw in its frame it has been common to project its upper end forward of the line of motion, so that as the saw descended its edge advanced along the log as fast as it cut; but sometimes the ways or guides on the fender posts upon which the log slides have been set inclined, so that while the saw itself was straight in the gate, the gate and saw both advanced while descending. There were objections to both of these devices. In hanging the saw over it was generally badly strained, and it often required adjusting; while with that, as well as the inclined ways, a cut of a determined distance must always be maintained, unless the parts were readjusted; the objections to this are, that in sawing large or small logs different feeds should be given; a log of two feet in diameter could not be cut so fast as one of one foot in diameter; and if, instead of feeding up the log just the distance of the rake of the saw, it is fed slower, the saw only cuts during a portion of its descent, and with a pecking action striking the log and straining the saw; this difficulty has long been felt by the practical sawyer, as well as the other defect, of cutting too slow in small timber. Recently a remedy has been devised for both these defects by Knowles, the ingenious inventor before named, who has hung his guides *a* for the saw-frame, as shown in the diagram below, by one end, the other being allowed a motion forward and back, regulated by a screw *b*; there are four of these guides, composed of straight bars of iron or steel planed true, upon which the boxes of the saw-frame slide; there are two of them on each fender post *c*, one above and the other below, each moved, as above stated, by a screw; all the screws being of the same pitch, and connected by an endless chain *d* passing over pulleys on their projecting ends behind the fender posts, they all turn together, and move the guides to exactly the same inclination, so as to throw the saw forward more or less on



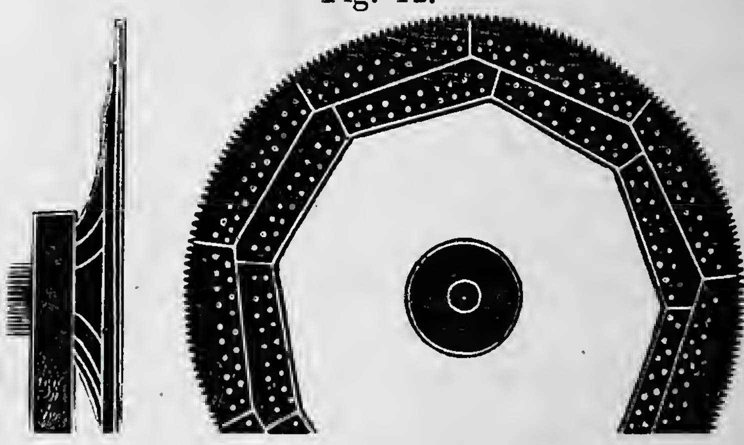
its downward stroke, according to the size of the log or its quality, relieving the saw readily in knots or other bad places, and keeping it always up to the greatest amount of work it is capable of; and as the feed exactly corresponds with the forward motion of the saw, it cuts its whole length, and wears equally instead of striking on its upper part only, and thus unduly bringing an improper strain upon the saw. Saws were steadied as early as the last century by guide pieces, embracing the sides of the saw just above and below the log; and this device has recently been employed, as well as rollers, between which the stuff is held while sawing.

Circular saws have been repeatedly brought into use for the supposed advantage of making a regular cut instead of the intermitted one of the upright saw, by which means the log could be moved regularly along. It was found in practice that a saw of large diameter, when it became heated, expanded so as to run irregular, or, in technical phrase, buckle: to remedy this, saws of smaller diameter have been used; and to cut through a log one saw was placed below the log, cutting up into it a little above the centre, and above the log was another saw cutting in the same plane, and a little behind the first, thus finishing the operation. But little practical utility was attained by this method: the mechanical difficulties of keeping the two saws in the same plane, the double geering to drive them, and in preventing either from a lateral inclination, has prevented their general introduction. A device to obviate the defect of expansion in large circular saws was made in this country some years since by giving an end-chase or lateral movement to the shaft, while the periphery of the saw was guided by two small rollers between which the saw runs. Thus any tendency of the saw

to run sideways was transferred from the outer circumference to the shaft. A modification and improvement of this has since been patented, by hanging the saw in a frame that is so jointed as to move easily sideways without causing the journal to slide.

In the early manufacture of circular saws a difficulty was found in constructing one of large diameter. A remedy for this was described in a patent granted to Brigadier-General Samuel Bentham,* in 1793, which is probably the most wonderful patent ever granted, and more fruitful of practical devices, that have since been frequently repeated with entire success. The title of the patent is for "*various new and improved methods, and means of working wood, metal, and other materials.*" Bentham proposed making the cutting portion of the saw in annular segments fastened upon the face of a large flanch affixed to the shaft: this is shown in the accompanying figure.† It was afterwards patented in 1806 by Brunel, who gained great fame and a title by this and other beautiful devices for the working of wood, every one of which may be traced in the patent of his predecessor, Bentham, whose name was strangely overlooked, while Brunel reaped both the fame and reward of his original devices.‡ This saw was often used for veneer cutting, and we believe is still employed for that purpose.

Fig. 12.



A patent was granted many years ago, in the United States, for forming a circular saw on a new plan; the saw consisted of a circular disk or plate,

* As the name of Samuel Bentham has often, within the last few years, been before the public, we here present a short sketch of his career. He was a brother of the celebrated Jeremy Bentham, and possessed a talent quite equal to his illustrious relation. He very early displayed a fondness for machinery and invention. A writer in the London Mechanics' Journal says: "After having received classical instruction at Westminster-school, his decided predilection for naval affairs induced the binding him to the master-shipwright of Woolwich Dockyard, with whom he served a regular apprenticeship of seven years, receiving at the same time with experience in manipulation, all the scientific instruction which could be obtained from the best professors of the day. He afterwards spent a year and a half in studying the practice of the several other Royal dockyards, and some time as a volunteer and captain's guest on board a first-rate ship in Keppel's fleet. His subsequent extensive travels in Europe and Siberia gave him great knowledge in a vast variety of manufacturing concerns. In Russia he was appointed a lieutenant-colonel, and given the superintendence of Prince Polemkins' manufactories at Dubrovna, near Pricheft. It may well be asked in what way so young a man had become competent to this vast undertaking? It was from a combination of scientific with practical education. Having obtained leave of absence, he came to England early in 1791: his turn for mechanical works led him, in 1791, to visit most of the great manufactories in England. He found much machinery in use for the spinning of cotton, but for the working in wood none, save some turning lathes, some circular and reciprocating saws, and some boring tools used by the Messrs. Taylors for making blocks. Shortly afterwards it happened that his brother, Jeremy Bentham, was engaged by government to undertake the introduction of industrial prisons: Samuel Bentham, with a view to render convict labor profitable, perfected a variety of machines of his invention for working stone, metals, cork, etc., and more particularly those for working wood, for which he obtained patents in 1791 and 1793."

† A recent writer remarks he saw one of Bentham's saws for cutting veneer, in which neither the saw, the kerf, or the veneer was thicker than writing-paper.

‡ Since writing the above, we have seen our views corroborated by a writer in the London Mechanics' Magazine, who adduces positive proof to sustain his position from government records.

of iron or steel, having recesses cut in its edge at certain intervals, into which were fitted teeth of the hawk-bill kind. There were only four pairs of these teeth—placed equidistant from each other, around the periphery. The recesses into which they were fitted were chamfered on the edge, and a V groove on the edge of the tooth slipped on to and embraced the chamfered edges. A small brass pin, riveted through a hole drilled at their juncture, held the parts firm in place.

Other forms of saws have also been brought into use; some of the most prominent of which are—the cylinder saw: this is a cylindrical tube of plate steel, with teeth cut on its edge; it has been employed for cutting round rods, the size of the interior of the saw, for button-making, and for surgical purposes;—the ring saw, which is the cylinder saw enlarged, and supported by its outer or inner circumference on pulleys, from the friction of which it is driven;—and lastly, the belt saw, which is an endless belt of steel, having teeth cut on one edge, and running over two pulleys, with a portion of its length kept straight for cutting. This saw seems wholly impracticable, has never been successfully brought into use, and probably never will be.

A recent saw, if the tool can be properly called a saw, has been devised for cutting out mortises. It consists of a compound flat endless chain, two, three, or more links broad, with a cutting-tooth on each link of the chain. This chain runs over two pulleys, like the belt saw; one of the pulleys is less in breadth than the saw, and when a piece of wood is brought in contact with that portion of the chain of cutters which is over the pulley the mortise is made; the pulley itself enters the mortise as the wood is removed by the cutters.

After the logs have been sawed into planks, the next operation in order is to smooth them for wainscots, floors, and other purposes. No labor of the carpenter has been more arduous than planing boards; and as early as 1791 a patent was taken out by Sir Samuel Bentham, the engineer before mentioned. This is the earliest positive date we have of a machine to be worked by other than manual power in the planing of boards. The plan is one which, after years of experience, has been found best adapted to the purpose, and which is now, with some modern improvements, coming into general use. A short sketch of this invention of Bentham's may here be interesting. His patent is for "a new method of planing wood;" it is dated 26th of November, 1791. The description is confined to such parts of the apparatus as the patentee deems to be new, leaving all details of construction to the skill and knowledge of the intelligent mechanic, who, to use his own language, "cannot now be much at a loss for means of executing the details of any of the species of work mentioned." The intention of Bentham was to supersede the hand-plane, and substitute unskilled labor, or some inanimate propelling force, for the artisan; he says, "The invention is, properly speaking, the invention not of a mode but of a principle; the modes in which that principle may be employed, and the species of work to the performance of which it may be applied, are innumerable;" and he says further, "The only course I can pursue is to give such a general and in a manner exhaustive view of the extent of the principle, of the manner of applying it, and of the sorts of work to which it may be applied, as to enable the public at large, upon the expiration of my term, to reap the benefit of my invention in its fullest extent." * * "Drawings are not given, as they would tend rather to confine the direction to a particular mode; whereas words may serve to convey the instructions in the most

general way, and with a latitude that will adapt itself to whatever variety of circumstances may present themselves, and the better enable the artist to pursue the invention through all its branches." It will be seen by this that Bentham does not intend to describe a perfectly organized machine. The frame he leaves for the mechanician to fashion; the device for moving the cutters or board are to be any of the common and well-known mechanisms. The usual devices known to all workers in wood are not dwelt upon, or the kind of power, or its mode of application. His description is confined to the novel elements of machinery required to effect a variety of purposes. For instance, to plane planks and boards to a uniform thickness; to plane the board or stuff with one edge thicker than the other; to plane tapering, so as to make a wedge-shaped piece, and to combine any of these devices; to make wavy or irregular cuts, either vertical or horizontal, which, together with moulding cutters, will make a great variety of figures: all these effects are clearly indicated in this patent. The elements for producing them are given throughout the patent, not in connection, for the reasons already quoted, but in every case designating the purpose of each device. There is no ambiguity in this, as the same course of classification is often adopted by eminent modern writers on mechanics. We will give the devices described in this patent in their natural order, beginning with the function of holding the board, while it is operated on by the plane. He says, "The accuracy of planing depends, even in the present mode, in some measure, upon the bench; in this new mode, an attention to the construction of that implement is particularly essential. For the case when the board winds so as to afford no surface on which it would lie firm on an ordinary bench, a compound bench may be employed, consisting of a middle part and two sides; the middle part serves for the support of the board to be planed, and is capable of being raised or lowered at pleasure; the sides are made to separate and close horizontally, so as to receive between them and keep steady a piece of any breadth. For this purpose they are furnished with one or more rows of flat teeth, which, without being long enough to damage the board, are numerous enough (in conjunction with a common stop or bench-hook) to keep it to its position." This, says the inventor, *may* be used to hold down the board; but his invention is not here exhausted, for he says this device is adapted to thick boards, and he adds further on, "But here it is necessary to observe, that in planing of boards not very thick, the board may at one part spring up to the iron [cutter], and the iron, having thus got hold of it, may not part with it until it has reduced it below the intended thickness, and in case of very thin boards, when though you keep down the edges in manner above mentioned, the middle may notwithstanding be apt to rise, there may be heavy rollers, or rollers loaded with weights, let through the sides of the plane as near the iron as may be, and on one or both sides of it" [that is, before and behind the cutting edge]. "In this manner, without any great additional consumption of moving force, the board, however thin, may be effectually kept down flat upon the bench." The compound bench, before described, affords an easy method of tapering a piece to any degree, either lengthways or crossways: this is done by raising one end of the middle portion of the bench, or one of its sides, as the case may be, and the piece laid upon this inclined surface will be cut to a taper by a plane passing over its upper surface.

So much for straight planing; but other effects are provided for. By a proper configuration of the guides upon the bench, the surface of the work may be made to receive curved forms, and those of a very complex

nature; to curve the work in a longitudinal direction, a corresponding curve is given to the sides of the bench or plane guides, and by moving the plane laterally also as it progresses, almost any variety of curvature may be produced, which, together with moulding plane-irons in combination, will produce very complex figures. A mode of moving the bench up to the plane may be adopted for the plan of moving the plane to the work.

"Where," says the inventor, "your board is of substance enough to admit of your confining it in such manner as to come at more than one surface" [that is, where it need not be fastened down along its edges], "you may easily connect planes together, or compound your plane so as for it to apply itself to either or both edges at the same time, as to one side. In case of a single edge, one means of confining to its work, the plane belonging to that edge is, by giving to the plane-iron of the plane belonging to the side a diagonal direction, as is sometimes done in rabbet-planes; or you may confine the plane at the edge, or a plane at each edge, by springs or guides. In this manner, edges of boards may receive any moulding, or be rabbeted, or tongued and grooved, at the same time that the side is planed."

The mechanical elements for cutting may be thus described from this patent. To begin with the simplest case, viz., when the board is already of the form required, it may be reduced and smoothed by drawing a plane over the board repeatedly; the board being laid upon a bench in the usual way, that is, as carpenters commonly do; "but the plane for this purpose must be made, in the first place, as broad, at least, as the board, and must be capable of cutting the whole breadth of the board at once. Secondly, the sides of the plane" [extending beyond the sides of the board] "may extend below the sole sufficiently to serve as guides to the plane. For making the stroke, the plane may be kept down by its own weight, or by being loaded," according to the force required. Specific directions are given how this gigantic plane should be constructed to come upon, and quit the board properly; its projecting cheeks determine the thickness to which the stuff shall be planed, and a mode of shifting the weight that presses the plane down from one end to the other as required. "If the board is finished at one stroke, the plane can be drawn back without injury, but if it requires repeated strokes," a contrivance is necessary to save the cutting edge in dragging the plane back on the board; a device for lifting the plane in such cases is then described.

Instead of taking but one shaving at a time the whole breadth of the board, several may at the same time be taken by disposing irons in the plane one behind and lower than another, so as to take off as many shavings in thickness as you please. "In this manner, so you apply force enough, you may perform almost any planing work at one stroke"—which may be either a flat surface or any moulding. "You may dispose irons enough, one after the other, to cut the piece through; and if you make them narrow enough, slitting or ploughing may in this manner take the place of sawing." As to the exact construction of the tools, the inventor says: "Minute instructions and dimensions cannot here be given, since these must be adapted to the nature of the wood." To obviate the necessity of cutting deep with its attendant disadvantages, it is proposed to apply "slitting planes" to the two opposite sides of the board, and each cut but half way. The ingenious inventor is aware that a many ironed plane is difficult to construct and work, as if any one of the irons is damaged or choked the operation fails; he says, "A better way may be to employ a number of separate planes following each other, each separately pressed down to the

work by its own weight or otherwise," by which device the bad effect of one plane not working may be avoided. "As to the mode of connection between the links of such a chain of planes, as simple a one as any may be an oblong frame, the sides of it furnished with perpendicular slits to receive pins projecting from the sides of each of the planes." "In the thickness of the shaving which these different planes are set to take off, there may be some difference; the foremost ones being set the rankest for the sake of riddance, the hinder ones the less rank for the sake of smoothness." How perfectly does all this accord with modern experience!

A toothed iron, to plane the board into channels for the purpose of speed and convenience, especially in cross-grained wood, instead of using double irons, is named by this fruitful inventor; after which the pieces between the channels are cut away. This device has since been patented in this country some fourteen years ago. It is suggested either to move the plane over the wood or moving the piece, the plane remaining fixed, or moving both. "The expedient of making the piece move, while the plane is fixed, may be particularly useful where the plane is so constructed as to *embrace the piece on all sides, whether it have cutters on all sides or not.*" This is the mode now used in all planing machines whether with stationary or rotary cutters. A description is given of planing tenons and mortises, but the arrangement is simple, and on the plan of the other operations, merely changing the form of the plane and its position to serve the purpose. In the closing remarks the patentee says, "With respect to the choice of the moving power and the manner of applying it, nothing need here be said. The choice between wind, water, steam, &c., is a consideration of economy."

The devices found in this patent may be thus summed up. For holding the board—first, it may lay on the bench as in ordinary planing, that is, by being simply held by a bench-hook at one end; secondly, a compound bench may be used having a bed for the piece to lie on, and two movable side-pieces to embrace the edges and clamp the piece on its sides the whole length; this is used in the case of thick winding pieces, which are not sufficiently straight to lay flat on the bench; thirdly, thin stuff that would be liable to be drawn up from the bed by the cutters, may be held down by heavy rollers, or rollers weighted, placed on either or both sides of the plane-iron, as near the edge as possible; and fourthly, the piece may be held by being embraced by the plane, that is, the part which holds the cutters, whether there are cutters on all sides or not. These devices are not described as being each used entirely separate, but may be used in combination or otherwise, as needed; their purpose is designated and their employment left to the discretion of the artisan as his wants require.

For planing or cutting the surface, we find the following devices: first, a cutter set in a stock, and only differing from a common plane by being wide enough to have the cutter reach entirely across the board; to this is added ribs along the two edges beyond the breadth of the board to bring the board down to a given thickness; and these ribs or guides may be put to any of the moving planes in one form or another. Secondly, a number of cutters may be put in one stock, one being placed lower than another, from front to rear, in proportion to the shaving each is to take off. Thirdly, a series of planes may be connected in an oblong frame, each of which planes can move up and down separately a limited distance, and will reduce the board to a given and equal thickness, the first planes of the series being set the rankest, and of course following any inequalities of the board, and taking off a shaving the whole length, unless the board was thinner than the gage. Fourthly, setting planes not only to plane the upper or

under surface of the board, or both, but also at the same time placing other planes so as to cut mouldings on the edge of the board, or tongues and grooves—the whole being done at one operation. This leaves nothing more to invent in stationary or reciprocating planing machines, except some nicer details, which modern skill has recently supplied, as we shall show in describing the latest and most perfect machines, in which stationary knives are used. We shall have more to say of the inventions of Bentham when we come to treat of rotary cutter planing-machines.

J. J. G., *Ed.*

THE IRON BRIDGE AT HARPER'S FERRY.

DESIGNED BY WENDEL BOLLMAN, AND PATENTED IN 1852.

This bridge is in many particulars new in principle. It is sustained upon four granite columns or abutments, some twelve feet in height above the piers, and only four feet square at the base, and two feet nine inches at the top. Upon these the bridge rests, entirely without thrust or contraction to affect the stability of such slender supports, all the strains being brought within the structure of the truss and suspension-frame. Its appearance is so novel and striking, that we have given it a place on the title-page of our cover. The particulars of the construction we shall give in the words of the ingenious inventor, together with the experiments of the superintendent of the Baltimore and Ohio Railroad (for which Company the bridge was built), whose name will be a sufficient guarantee for the correctness of the report. The experiments were fully confirmed by tests we ourselves witnessed at this bridge.

J. J. G., *Ed.*

DESCRIPTION OF THE BRIDGE AS BUILT AT HARPER'S FERRY.

The span of the iron suspension and trussed bridge erected at Harper's Ferry is 124 feet between abutments. The length of cast-iron in the stretcher is 128 feet. The weight of cast-iron in the R. R. truss is 65,137 lbs.; of wrought-iron, 33,527 lbs.; making a total weight of cast and wrought iron equal to 98,664 lbs.

From an examination of the engraving it will be found that the wrought-iron requires but little workmanship; the rods from the centre to the abutments having simply an eye at one end, and a screw at the other, with a weld or two between, according to the length. The long counter-rods have two knuckles and one swivel for adjusting the strain and for convenience in welding, as well as in raising the whole to its place.

The cast-iron stretcher is a hollow bar, octagonal without and circular within; it averages one inch of metal in thickness. It is cast in lengths according to the length of the panels, and is joined in the simplest manner. At one end of each length is a tenon, at the other, a socket; the latter is bored out, and the tenon and its shoulder turned off in a lathe to fit the socket, so that when the sections are thoroughly joined, they form one continuous pipe between the abutments. The ends of the sections of the cylinders inserted into those contiguous are slightly rounded, to allow a small angular movement without risk of fracturing the joint.

A cast-iron plate, or washer, A, sets on a bracket cast with each abutment-end of the stretcher, and at right angles to the centre acting-rods B. The

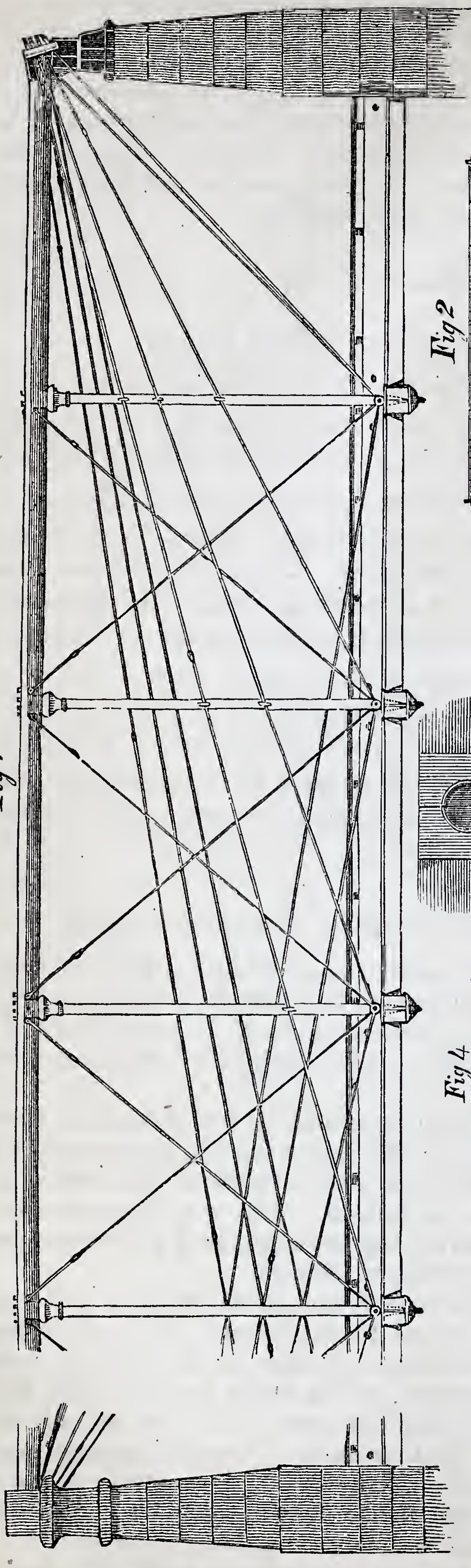


Fig 1

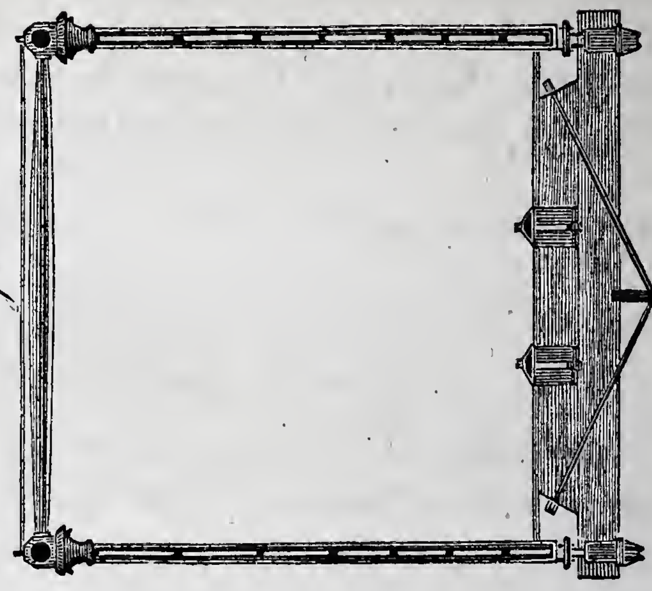


Fig 2

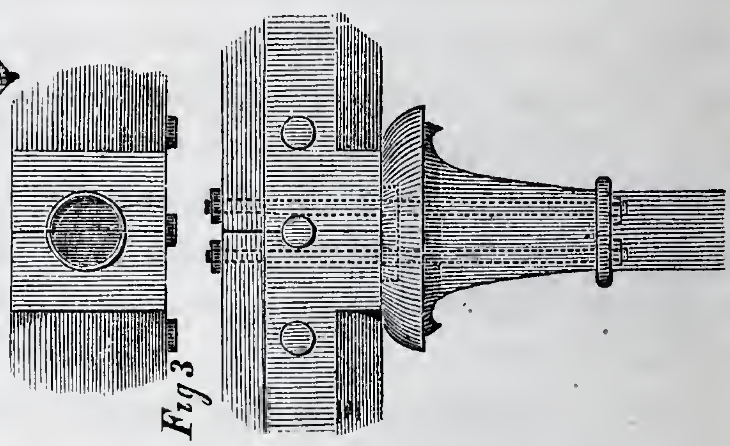


Fig 3

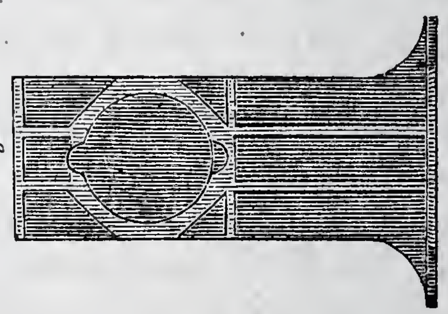


Fig 4

tension-bars are passed through this washer to receive a screw-nut for fastening the bars and adjusting the system.

Each post is cast with a seat in the abacus to receive a ring-tenon cast upon the under side of the stretcher, and bolted through, as in Fig. 3. The slots or openings in the post, as seen in the cross-section of the bridge, give a free passage to the suspension-rods. Through the floor end of each post there is an eye-bolt which receives the eye-ends of the tension, diagonal, and suspender rods; the latter, being bolted through a cast-iron plate, sustain the floor cross-beams, and their seat, the suspender-washer. Sufficient play is here given by a slot in the plate and in the cross-beams for strain and expansion.

The stretcher or straining-beam, the vertical posts, and the suspension-bars compose the essential features of the bridge; each post being hung by two bars from both ends of the stretcher independently of all the others, and each post and pair of tension-bars forming with the stretcher a separate truss.

This system, perfect in itself, is additionally connected by diagonal rods in each panel; also, by light, hollow castings, acting as struts—(see Fig. 2.) The diagonal side-rods might be safely dispensed with, for the peculiar merit of the truss is its perfect independence of such provision; they are used as a safeguard only in case of the fracture of any of the principal suspension-rods.

By this combination of cast and wrought iron the former is in a state of compression, the latter in a state of tension—the proper condition for obtaining the best effect from the two metals. The principles of the suspension and of the truss bridges are here united. *Each* bar performs its own part in supporting the load in proportion to its distance from the abutment; so that the entire series of suspending-rods transmits the same tension to the points of support as would be equally transmitted from thence to the centre of bridge. Each bar or rod is straight and of a uniform figure, and therefore the elements of calculation are as simple as those of the lever, "when the fulcrum is at one extremity, the power at the other, and the weight to be supported at some intermediate point." This first principle of the lever is here exemplified in its most naked simplicity, it being sustained in equilibrium by a force applied at a given point and acting in a given direction. Consequently, by the property of the lever, the power multiplied by its distance from the fulcrum, is equal to the weight multiplied by its distance from the fulcrum. The power and weight are reciprocally as the distances. Pressure upon the fulcrum is the difference of the weight and the power.

Now to proceed, as in the annexed diagram, for the proportion of one rib —that is,

One-half the Weight of Bridge and Load.

Weight of iron,	24,000 lbs.	
" " timber,	15,000 "	
" " load,	184,000 "	
" " momentum,	25,000 "	
	248,000 "	The total weight to be sustained by one rib.

This, when distributed, is carried at eight different points—at the centre by two equal, and on either side by two unequal forces. Therefore, $\frac{248,000}{8}$ = 31,000 lbs. on each post; or, in other words, there is a concentration of 31,000 lbs. on each floor-beam at the points of suspension.

The distance from the centre of the abutment to the centre of the bridge

$= 64$ ft.; so that $\frac{31\cdot000\times64}{128} = 15{,}500$ lbs. weight on the acting-rods at the centre, the forces being equal.

The distance from the centre of the abutment, or the point of support, to the centre of the post or internal line of the first or abutment panel $= 17\cdot5$; therefore, applying the principles of the lever, as before mentioned, we have transferred to the furthest point of support $\frac{31\cdot000\times17\cdot5}{128} = 4238$ lbs. as the weight, which, deducted from 31,000 lbs., leaves 26,761·8 lbs., as the weight transferred to the nearest point of support.

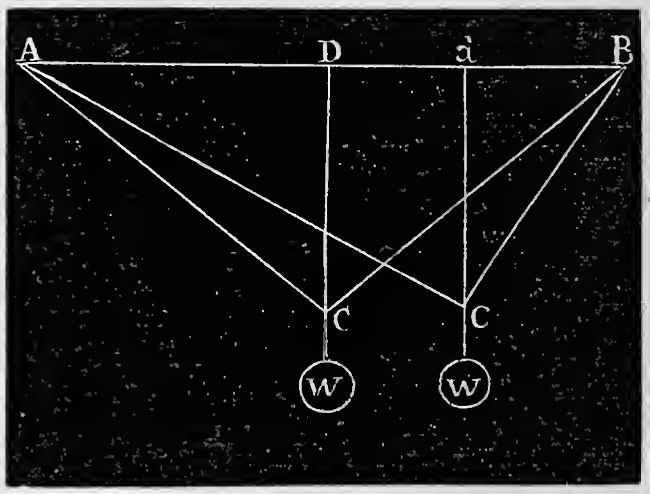
To use further plainness in the application of first principles, let us take the following diagram.

A D $= \frac{1}{2}$ A B $= 6$

A d $= \frac{2}{3}$ A B $= 9$

B d $= \frac{1}{3}$ A B $= 3$

W $= 144$



In the triangle A C B, A C = C B. Then, the weight being between the fulcrum and power, A B : A D or D B : : W : A C or B C, or 12 : 6 : : 144 : 72 lbs., or $\frac{144\times6}{12} = 72$ lbs. weight on A C or B C—the forces being equal.

B d = 3. Then A B : B d : : W : A c′, or 12 : 3 : : 144 : 36 lbs., or $\frac{144\times3}{12} = 36$—144=108 lbs. on B c′, or by proportion, A B : A d : : W : B c′, or 12 : 9 : : 144 : 108 lbs. on B c′—the forces being unequal.

With this simple key to the calculation by first principles of mechanics, within the compass of every practical man, we shall consider the harmony of this system.

This bridge, it will be seen, is composed of seven independent trusses, which transfer the weight concentrated on each floor-beam directly to the abutments without aid from any other connection, and not from panel to panel as in general use.

The strain on both the cast and wrought iron is wholly in a direct line; and the result is, the minimum quantity of metal required to carry a given weight. Its security and economy are evident; the weight of the bridge and load rests on the piers, towers, &c., the only horizontal thrust being from the expansion of iron, which is accommodated by rollers and the sliding of the abutment-bracket over its pedestal, or by any other means: the necessary dimensions of the masonry may therefore be extremely moderate.

It is evident, from an inspection of the engraving, that no chord is requisite at the bottom of the truss to resist tension; the only advantage of that employed is to regulate the movement produced by expansion, in the performance of which agency it acts as a resistant to compression.

Although the abutment-bracket-casting and its pedestal in the Harper's Ferry Bridge were so constructed as to admit of accommodation to expansion by rollers, yet this contrivance was omitted with the view of fully testing the effect of the greatest expansion throughout the system.

The pedestal is seated on and embraces the top of the granite column. This pedestal and bracket were carefully planed off to true surfaces for the purpose of reducing the amount of friction between them.

It is now more than a year since this bridge was erected at Harper's Ferry, during which time it has been exposed to extremes of cold and heat, and to an average run of twenty trains daily.

From the closest inspection we find that the extreme expansion measures, as near as possible, 5-16 of an inch on each tower, or 5-8 in the entire length, 128 feet of stretcher, and without the slightest perceptible derangement of masonry; the dimensions of which are 4 feet square at the base, 12 feet high, and 2 feet 9 inches square at the top.

While on the subject of expansion, it may be well to notice the effect from difference in the expansion of the rods of different lengths. At the first point of suspension, or where the longest and shortest rods meet, the counter-rod is about four and a half times longer than the acting-rod, and the expansion of the counter is four and a half times that of the acting-rod. But there is also a proportionate difference in the lengths of the parts of the stretcher from the point directly over the centre of connection to the extremities of these rods. This has been practically proved in this bridge.

The suspender-bolt, when the expansion is extreme, or 5-8 of an inch in the length of the stretcher, exhibits a difference of 3-16 towards the short or acting-rod, which difference is provided for, as seen by slot dotted in Elevation, Fig. 1, where the vertical suspender-bolt moves to accommodate any such difference, and to give that proportion of weight to each rod according to the angle.

This bridge affords easy access for repairs—for instance, should a new floor-beam be required, it is but needed to slacken the horizontal-rod and the keys in the longitudinal strut, remove the washer from under the point of suspension, and let down the beam to be replaced, which can be done without trustling up any part of the bridge.

In case of fire, the floor may be entirely consumed without any injury to the side truss.

" Particulars of a trial made under my supervision on the 1st day of June, 1852, to prove the stiffness of an iron bridge erected by Wendel Bollman, at Harper's Ferry, and known as the Winchester Span of the R. R. Viaduct at that place.

"Three first-class tonnage engines, with three tenders, were first carefully weighed, and then run upon the bridge, at the same time nearly covering its whole length, and weighing, in the aggregate, 273,550 lbs., or 136,775 tons net, being over a ton for each foot in length of the bridge.

"This burden was tried at about eight miles per hour, and the deflections, according to gages properly set and reliable in their action, were at centre post, $1\frac{3}{8}''$, and at the first post from abutment, 9-16 of an inch.

" It may be satisfactory to give also the tests applied to an iron bridge, of similar principle, of 76 feet span, on the Washington Branch R. R., erected by Wendel Bollman, and their results.

" A passenger-train passing quickly caused a deflection of 9-16 of an inch at the centre. An engine and tender weighing forty tons of 2240 lbs. caused a deflection of 5-8 of an inch. Two engines and tenders at rest—back to back—an aggregate of $77\frac{1}{2}$ tons, caused 11-16ths deflection; the same, at ten miles per hour, 13-16ths; the same, head to head, under motion gave, at 4 miles per hour, ... 13-16ths.
8 " " . . . . a *little* more.
20 " " . . . . . . 14-16ths.

"W. PARKER, *Sup't. B. & O. R. R.*"

From the test at Harper's Ferry it is found that the load did not cover the entire length of bridge by about thirteen feet, yet the excess of weight in the middle, and at a speed of about eight miles per hour, produced no greater deflection than $1\frac{3}{8}$ of an inch at the centre post, and 9-16 of an inch at the first point from abutment.

It may be well to add, for general explanation of the last trial on the Washington Branch R. R., that when two first-class engines and tenders stand *head to head*, they nearly concentrate a weight of 48 tons in 36 feet; yet at twenty miles per hour the deflection at centre was but 14-16ths.

DECISIONS OF THE SUPREME COURT OF THE UNITED STATES IN PATENT CASES.

1829. PENNOCK & SELLERS *vs.* DIALOGUE.—1 *Peters' R.* p. 1, Act 1793.

It is no ground of error, that the court below omitted directions to the jury upon points of law, when neither party requested it at the trial. The party desiring instruction upon a particular question of law, should request such instruction.

An inventor may abandon his invention, and surrender or dedicate it to the public. This inchoate right, thus once gone, cannot afterwards be resumed at his pleasure; for where gifts are once made to the public in this way, they become absolute. It is generally a question of fact for the jury to determine, whether the acts or acquiescence of the party furnish satisfactory evidence of abandonment or dedication. But when all the facts are given, the court may state the legal conclusion deducible from them.

The patent act of 1793 prescribes the terms and conditions, and manner of obtaining patents, and proof of a strict compliance with them lies on the foundation of the title acquired by the patentee.

Many of the provisions of our patent act are derived from the principles and practice which prevailed in England; but the language of the English statute of monopolies is not identical with our patent act; English decisions, however, may serve to illustrate some of the provisions of our statute.

The words "not known or used before the application" must mean, not known or used by the public before the application.

If an inventor should retain the monopoly, and make and sell his invention publicly for years, and only apply for a patent when he feared competition, it would materially retard the progress of science and the useful arts, and give a premium to those who should be least prompt to communicate their discoveries.

The English statute of monopolies provides "that letters-patent and grants of privileges for fourteen years or under, for the sole working or making of any manner of new manufactures within this realm to the true and first inventor and inventors of such manufactures, which others, at the time of making such letters-patent and grants, shall not use." The use referred to here is a public and not a private or surreptitious use, in fraud of the inventor.

Under the English statute, if the inventor suffered the thing invented to be sold and go into public use for four months, the grant was void. "To entitle a man to a patent, the invention must be new to the world. The public sale of that which is afterwards made the subject of a patent, though sold by the inventor only, makes the patent void."

No other interpretation can be fairly put upon our statute. If an inven-

tion is used by the public, with the consent of the inventor, at the time of his application for a patent, such patent, if granted, will be invalid.

Where the suggestions of the patentee are not true, and the conditions on which alone the grant was authorized to be made do not exist, a patent is not good.

A fraudulent or piratical use by a third person might not defeat a patent. The legislature did not intend to grant an exclusive right to any one to monopolize that which was already in common use.

The sixth section certainly does not enumerate all the defences which may be interposed to suits on patents. It gives the right to a patent to the first and true inventor, and to him only; if known or used before his supposed discovery, he is not the first, though he may be a true inventor. But if he put it into public use, or sell it for public use, before he applies for a patent this would furnish another bar to his claim. This would be an abandonment, creating a disability to comply with the terms and conditions on which alone a patent can be granted.

1832. Grant and others *vs.* Raymond.—6 *Peters,* p. 218, Act of 1793.

The Secretary of State in issuing patents is a mere ministerial officer, and can exercise no power which is not expressly given. If the forms of law are complied with, he can exercise no judgment whether the patent shall be issued or not.

A new patent issued where the old one has been surrendered, can only be sustained on the general spirit and object of the law, and not upon its letter.

Inadvertency or mistake is a judicial question which cannot be decided by the Secretary of State.

Neither can he decide those judicial questions on which the validity of the first patent depends; yet he issues it without inquiring into them. The correct performance of all those preliminaries on which the validity of the original patent depends, are always examinable in the court in which a suit for its violation shall be brought.

The rightfulness of issuing the new patent is declared to depend on the fact that "the defect in the specification arose from inadvertence or mistake, and without any fraud or misconduct on the part of the patentee." This is a question for the jury.

A party may plead his defence specially, or plead the general issue, and give notice of special matter under the sixth section. If he shows that the patentee failed in any of those prerequisites on which authority to issue a patent is made to depend, his defence is complete. He is entitled to the verdict of the jury and the judgment of the court.

If he wishes to annul the patent, he must follow the statute strictly. Evidence "tending to prove that the specification filed by the plaintiff does not contain the whole truth relative to his discovery, or that it contains more than is necessary to produce the described effect," will protect the defendant. But in order to authorize a judgment declaring the patent void, he must go further, and show such "concealment or addition" to have been made "for the purpose of deceiving the public." The evidence of fraudulent intent is only required where it is sought to annul the patent.

A defective specification is a good defence, although it did not originate from design.

In consequence of the ministerial character, in which the Secretary of State acts, the performance of the prerequisites, on which a patent can issue, must be examinable in any suit brought upon it.

The English books are full of cases in which it has been held that a defective specification is a good bar when pleaded to, and a sufficient defence when given in evidence on the general issue, in an action brought for the infringement of a patent right.

Whether an inventor has abandoned his invention, or dedicated it to public use, is not a question of intention, "but of legal inference, resulting from the conduct of the inventor, and affecting the interests of the public."

The case of *Pennock* vs. *Dialogue*, 1 Pet. 1, affirms the principle that a failure on the part of the patentee, in those prerequisites of the act which authorize a patent, is a bar to a recovery to an action for its infringement; and that the validity of this defence does not depend on the intention of the inventor, but is a legal inference upon his conduct.

1833. SHAW *vs.* COOPER—7 *Peters' R.* p. 292, Acts of 1793 and 1800.

The decision in the case of *Grant* vs. *Raymond*, 6 Peters, 220, referred to and confirmed. When a patent is surrendered and a new one issued, it is a continuation of the first patent, and runs from the date of the first year.

The application for the new patent may be considered as appended to the original application.

The second patent being a continuation of the first, the rights of the patentee must be ascertained by the law under which the original application was made.

The first patent in this case was issued under the law of 1800, which required the applicant to make oath that to the best of his knowledge and belief that the invention had not been known or used in this, or any foreign country; and it provided if it had been the patent should be void.

The act of 1793 provided that every person in his application for a patent shall state that the invention was *not known or used* before such application.

The sixth section of this act provides that if the thing patented had not been originally discovered by the patentee, but had been in use before the discovery of the patentec, the patent should be void.

It seems that citizens and aliens are placed substantially upon the same ground. "In either case, if the invention was known or used by the public before it was patented, the patent is void. In both cases the right must be tested by the same rule."

By the act of 1793, if a thing was known or used by the public before the application, a patent will not be sustained.

The knowledge spoken of in the act of 1793 is public knowledge. If surreptitiously obtained, it will not affect the right of the inventor, though acquiescence on his part will lay the foundation of a presumption against him.

In England it was held in one case that suffering the invention to be sold and used for four months would render the patent invalid. In a later case it was held, that allowing it for any period would render the patent utterly void.

Vigilance is necessary to entitle a party to privileges secured under the patent law.

If the invention is fraudulently made known to the public, the inventor should assert his right immediately, and take the necessary steps to legalize it.

An inventor's right does not depend alone upon his discovery, but also upon the legal sanctions which have been given to it, and the forms of law with which it has been clothed.

No matter by what means an invention may be communicated to the

public before a patent is obtained, any acquiescence in the public use, by the inventor, will be an abandonment of his right.

His right would be secured by giving public notice that he was the inventor of the thing used, and that he should apply for a patent.

An acquiescence cannot be presumed when the inventor has no knowledge of such use. Knowledge may be presumed from circumstances. This will generally be a question for the jury.

After a patent is granted, no subsequent use can affect the patentee's right.

The same evidence which would defeat an application for a patent would, at any subsequent period, be fatal to the patentee's rights.

The evidence he presents to obtain a patent is not only *ex parte* but interested; and the questions of fact are left open to be controverted by any one who contests his right under the patent.

A strict construction, as it regards the public use of an invention, before it is patented, is required by the letter and policy of the law.

A presumed acquiescence when the public use is known, or might be known to the inventor, is the only safe rule which can be adopted.

In some of the cases at the circuits, the question of abandonment was made to depend upon the intention of the inventor. But these cases were overruled in *Pennock* vs. *Dialogue.*

Whatever may be the intention of the inventor, if he suffers his invention to go into public use, through any means whatsoever, without an immediate assertion of his right, he is not entitled to a patent, nor will a patent obtained under such circumstances protect his right. R. H. G.

NOTE.—The reader will bear in mind that the decisions which we now give, are under the act of 1793 and the amendment of 1800. In several important particulars, these acts differ from that of 1836, and those subsequent to it. These differences will appear when we give the adjudications under the latter acts. The decisions under the act of 1793 led to several changes found in the statute of 1836. The early decisions are necessary to a proper understanding of the more recent statutes, and the adjudications under them.

REVIEW OF THE OPINION OF THE HON. J. K. KANE,

In the Circuit Court of the Eastern District of Pennsylvania, in the cases: Sloat vs. *Patton; Sloat* vs. *Winslow; Wilson* vs. *Snowden; Wilson* vs. *Ashton.—Motions for special injunctions.*

IT becomes our duty as faithful journalists, devoted to the interests of inventors and mechanics, to notice the opinion of his Honor Judge Kane, in the above cases, as published and copied recently in several periodicals devoted to mechanics.

The courts have had an increasing demand made upon their time of late years to such an extent, that it may come to be a grave question whether or not some special tribunal shall be constituted to try the questions involving the validity of, and interferences with, Letters-Patent for inventions in the useful arts, leaving to the Circuit Courts the other issues only. It cannot be expected that the District or Circuit Judges will understand the questions of abstract mechanics, and their nicer adaptation and application

to the trades and callings that constitute most of the inventions upon which patents are based. To remedy the want of knowledge in the judges, a system of introducing "experts" has been adopted; persons with more or less knowledge, who come before the court and deliver their opinions under oath, explanatory of the inventions at issue, and also to what degree the mechanical equivalents extend, and upon questions of identity or otherwise, of any two or more devices. These "experts" rarely have any great amount of knowledge of the history of the arts, and are often found to be strongly prejudiced in favor of the side for which they are testifying: they frequently mislead the court by an ignorance of science, or a misapplication of it in a truly deplorable way. In illustration of this we have but to refer to the antagonistic opinions of "experts" in almost every important patent case. An "expert" should, no doubt, be a man thoroughly versed in all the questions of abstract science involved in the case: he should also be well acquainted with the practical working of the improvement upon which he is called to testify. If a chemist is called in to testify as to chemical equivalents, it is not enough that he should know that certain ingredients are considered isometric to determine them to be equivalents, but he must have seen them compounded, and be able to prove whether or not the same identical effect is produced by both. So with the mechanical "expert," he should be well informed upon the history of the art about which he is to testify; he should be thorough in his mechanics, and have witnessed the operation of the machines or the things about which he is to give an opinion. In this, as in most other cases, "a little learning is a dangerous thing" to rely on. Unless he masters the reasons for the results he is to testify about, he is even more unsafe than the most common witness who has no theory to defend, or nice points of difficulty to avoid; but above all, "experts" should, if possible, be appointed by the court, and not be in the employ of either party litigating; they should have ample time and opportunity to investigate and receive explanations, and then, as now, give in their deposition based upon the facts.

We have been led into these remarks from the character of the opinion of the learned judge; for he could only be led into the grave historical and mechanical errors therein contained by the testimony upon which he relied. But we must first notice the position of the court in declining to entertain the question of the validity of the patents in controversy, assuming the ground, if we correctly understand him from the imperfect report—that if A, B, and C, and so on down to Y, have unsuccessfully contested the validity of a patent, then Z, if he is overflowing with proof, shall not use it to defend himself against an unjust attack because of a decision in which he had no part—we trust there is some error in this. Another point of importance is the order of the judge, giving a person employed by the complainants power to inspect, and cause to be worked, the defendants' machines, *in any way he might request.* We question the propriety of such a license being given to either party in a suit. We know nothing of the individual, or what his testimony was, or how far it affected the issue, but we believe the principle involved to be unsound.

The learned judge is reported to say, in his opinion, that from the time of Bramah, half a century ago, until now, planing with knives set upon a disk, and made to revolve in the plane of the intended surface, *has never been successful.* Where the judge's authority comes from for this assertion, we know not, but it is a notorious fact, that the Bramah machine has been successfully used from the time of its invention to the present day in England, and is, and has been used to plane surfaces in various parts of this

country. Can the judge assume that an invention is worthless which is so carefully figured and described in works of the highest authority, unless he is assured of it by the most positive testimony? If there was any such testimony before the court, perjury must have been committed by the witness who so testified.

We pass over the philosophical reasoning of the judge upon the assumption of a fact that has no existence, simply remarking that, if on the first experiment with a disk machine it was found to mark the planed surface by what the judge is pleased to call the "*back-lash*," we cannot believe that even he would contend there was any invention in simply bending the finished part of the board out of the way; at all events, the originator of this device never thought it worth while to claim any credit for it.

The next statement in this opinion of the learned judge strikes us with more astonishment than any other. It is in the following words: "Woodworth *was the first* to propose a remedy for this, by placing his cutters on the periphery of a rotating cylinder, while he presented the face of the board in the tangent plane of their revolution *** and *gave the dip and lift cut* which has been so *often recognized as the characteristic of his patented machine.*" In the face of the disclaimer in the original patent of Woodworth we do not perceive how it is possible for the judge to assume, that Woodworth first proposed the dip and lift cut, or in other, and less fanciful language, the revolving cylinder of knives. Woodworth absolutely disclaimed this in his original patent, frankly avowing they had long been in use; but if he had not, it is well known patents had been repeatedly taken for it long prior to Woodworth's day, and his reissued patent of 1845 claims this simply in combination with another device.

The judge goes on to say, numerous witnesses all swore to the fact, that the machine in controversy was a *disk* [or wheel flat on its face], and that its cutters moved in the same plane, and parallel with the lower face of the boards. "But," the judge gravely adds, "*it is as certain as any truth in the philosophy of mechanics, that in this they are mistaken.*" And why? because it interferes with a theory the learned judge has adopted, probably, either from some of the "*experts*," or the ingenious counsel in the case, aided, perhaps, by the gentleman's ingenuity who passed boards through the machines by the court's order, which were thus *made* to show a dip and lift cut.

This hocus pocus in mechanics, of turning one machine into another totally dissimilar, is not novel to us, and has been quite too common in our courts within the last few years, displaying very much the same kind of talent as the juggler possesses who turns a fan into "my grandmother's rocking-chair." We profess no supernatural power, or very great dexterity, but we could easily show the learned judge how to plane boards with a revolving disk and leave *no* "*back-lash*," or, as we should say, scoring, upon the planed surface; to be sure, we should be forced to do it just as it has always before been done, and without any different effect from that of Bramah's—but still, efficiently. We suspect his honor was somewhat misled in his philosophy of mechanics by the defendants themselves, but knowing nothing of the defendants or their machines, we are unable to say. We are dealing simply with the broad questions of fact involved in the opinion.

The judge again goes on to say, "It is true, that upon *tramming* the disk with the bed-plate, to test their parallelism [by which we suppose he means measuring], the defendant's witnesses observed no deviation from the disk form [a plane-faced wheel]. But though this were so, yet in just such a disk the cutters might be arranged in such a manner as to describe a cone

when revolving." If we understand the judge's mechanical elements here, we confess we should be at a loss to know how a cone-cutter could be made out of them, even of the most infinitesimal character.

From the context we presume the judge has been led to suppose that a wheel or disk whose face is flat, having its shaft or axis perpendicular to its plane face, and its cutters on the same, or a parallel plane, can by inclining its shaft be made to cut conically; for he says that the machine, while at rest, can be modified so as to give proof for the time of the parallelism of its parts, and while in motion it may be set to cut slightly conical. Our *mechanical philosophy* teaches us this is a physical impossibility; and we have no doubt we should have a majority of all mechanicians, and every mathematician with us on this point. The paradox of which the judge complains is all founded in preconceived error: the fact that boards are, and for many years have been, planed by a plane-faced wheel, stands out as stubbornly as the man's foot did in the stocks, while his learned counsel argued that it could not be there.

In speaking of the tongueing and grooving apparatus, the judge tells us that "it consists of a revolving saw-plane of *lozenge shape*, set at such an oblique angle as to make all the teeth on its *periphery* equidistant from its axis of motion. In revolving it describes, *of course*, a cylinder." Most assuredly this is a paradox requiring more ingenuity to construct than was ever yet the gift of man: but, assuming for the judge some meaning in this sentence, there is still wide latitude for a play of talent to make out of this device a *duck-bill cutter*. From the opinion of the court, it would seem that the defendants' case was lost from a want of knowledge of common-place facts, and a misconception by the court of all the devices involved in the issues tried.

While we regret that Judge Kane should, in the last paragraph, seem to imply that *all* machines to plane boards *must* necessarily be an infringement of the Woodworth Patent, we quote his closing remarks with great satisfaction, and heartily respond to the truth they convey.

"It is a truth of large acceptation, both in policy and morals, that it is better in the long run to strive patiently for a legal property of one's own, than to persist in trespassing on the property of others. The invention which is set forth in letters-patent *belongs* to the inventor—as rightfully as the house he has built or the coat he wears. It cannot detract from the dignity of his title, that the subject of it is of his own creation, his thought, conceived and developed and matured in the recesses of his mind; that it has cost no man else any thing, and asks nothing in return for the contribution it makes to the general wealth and happiness, but that security of enjoyment, during a limited period, which the laws engage for all other property without limitation of time, and without stipulating a price. It would be a reproach to the judicial system, if an ownership of this sort could be violated profitably or with impunity."

J. J. G. *Ed.*

SOME OF THE WRITTEN RULES OF THE PATENT OFFICE.

[Continued from page 27.]

The rules of the Patent Office relating to patent agents are covert personalities, entirely unbecoming the dignity of public office. If a patent agent should defraud or "impose upon an inventor," the Patent Office is not the mediator or apologist, though its published circular places it in this attitude. In such cases redress is at law or between the parties. The office has undoubtedly the right to adopt rules for the transactions of business with all persons, and to enforce such rules to the exclusion of any one who seeks to annoy, evade, or refuses compliance. The fact is too well established to be advocated or denied that competent patent agents are useful and important to inventors and the Patent Office, and they are an indispensable part of the patent system in every country where patent laws are granted. There may be dishonest men among them, but it is unjust on that account to malign them as a body. Formerly there were patent agents in Washington who kept "*stool pigeons*" about the porch and vestibule of the Patent Office, but this system was broken up by the energy of Commissioner Burke. The parade of integrity, impartiality, and incorruptibility of the Patent Office, which accompanies the written rules for patent agents, is in bad taste, to say the least. We cite two passages: "Patents are granted or rejected upon the merits of the cases presented, and there are no circumstances which can, with the knowledge of the undersigned, be brought to bear, to turn the office from the strictest impartiality."

Again: "It is hardly necessary to state that no fees are received in this office, except those provided by law, and that no offers of sums of money, or payment of the same to third parties, can influence the decision upon a case, or hasten the period of its examination." From an experience of ten years in the Patent Office, we can testify to the general probity and ability of its officers, but while there, we were constantly mortified at the above and other seeming attempts to foreclose doubts and forestall public opinion by such ostentation of the moral purity of the Patent Office.

It is very remarkable that the same circular of information which so attempts to disparage patent agents, and dissuade inventors from seeking their assistance, contains also some remarks recommending inventors to employ patent agents. Thus in one place it holds the following language, viz.:

"To relieve applicants from the expense of employing agents, the examiners will decide questions of novelty and patentability upon papers imperfectly prepared, if sufficiently perspicuous to be understood, *when such papers are prepared by the inventor himself*. But if an agent be employed, it is presumed that he is qualified for the business he has undertaken without calling on the office for instructions.

"Inventors desirous of examining models before making application, should apply to the Commissioner or chief clerk, who will direct the machinist to aid them in all necessary inquiries. This caution is given to save applicants from impositions to which they are exposed. If the services of patent agents are desired, able and faithful ones can be found *at their offices* in this and other cities."

And then again: "The Patent Office does not make original drawings to accompany applications for patent. It furnishes copies of the same only after the patent is completed. Draughtsmen in the city of Washington are always ready to make drawings at the expense of the patentees."

And again: "The personal attendance of an applicant at the Patent Of-

fice is unnecessary. The business cae be done by correspondence or by attorney. All explanations and suggestions in relation to pending, and to all other cases, should be in writing, addressed to the Commissioner; correspondence with the examiners or other subordinates is strictly prohibited. When an application has been *finally decided*, the office will retain the original papers, allowing the applicant to obtain copies thereof."

And lastly, in a spirit of partiality and unwarrantable discrimination, it declares: "An examination, as to originality of invention, may be made on a single drawing, when no agent is employed; but in all cases presented by agents or attorneys, duplicate drawings must be filed before any examination can be had. They must be signed by the patentee, and attested by two witnesses, except when the specification describes the sections or figures, and refers to the parts by letters; in which case they are neither required to be signed, nor accompanied by written references, the whole making one instrument. Drawings are absolutely necessary when the case admits of them. They must be on separate sheets, distinct from the specification, and one at least must be made on stiff drawing-paper."

This last order of Commissioner Ewbank is in direct violation of law and justice. The law requires (see sec. 6, act of March 3, 1837) positively the "applicant for a patent to furnish duplicate drawings in all cases admitting drawings." The Patent Office formerly, by way of indulgence, allowed applications to be entered with one drawing, and required two in case of granting the patent. This practice was not only loose, but as time has and will more plainly show, unfortunate. The drawings of the records in the Patent Office are much mutilated, and will not last many years; and it would have been far better for the office, patentees, and inventors generally, if the law had required *triplicate* drawings. We remember once recommending the grant of a patent for an improvement in spectacles, when a patented drawing was *out of the portfolio*, which represented the identical invention. This drawing had been taken out by some person to examine, or it was in the hands of some person to make a duplicate of it. The patent was issued, and thus there were two patents for the identical invention. But to return to the law and rules. Without assigning any reason whatever, the Patent Office enforces the law upon one class of men, patent agents, and discards it for another, viz., inventors who choose to put in their applications in an imperfect condition. In the absence of a reason we have a right to the inference that such a rule was made to serve some personal ends.

We are glad to find that the present Commissioner is fully alive to many of the peculiarities of this circular of information, and also of the defects in the patent laws. It is worthy of note that during the whole of the administration of the Patent Office by Mr. Ewbank, nothing whatever was done for the reform of patent law, or in any way to aid the cause of the *inventors*, for whom he proclaimed so much sympathy in his reports, *passim*. The Hon. D. K. Cartter, the present able Chairman of the Committee of Patents in the House, has taken a very lively interest in the subject of patent law, and possessed as he is of enlarged and liberal views upon this subject, we are sure that he would have been very ready to have cooperated with the Patent Office in bringing about those reforms so very desirable, and which have been urged upon Congress by inventors, without any disposition on the part of the former Commissioner of Patents to respond to their wishes, or even give the subject merited attention.

C. G. P., *Ed.*

NOTE.—Since the above was in type, we have received a copy of a new set of rules by the present Commissioner that seems to correct most if not all of the objections to the former pamphlet.

ON ARABIAN HORSES.

[Translated for the American Polytechnic Journal from the work of General Daumas, entitled " Les Chevaux du Sahara."]

GENERAL PRINCIPLES OF THE ARABIAN HORSEMAN.

A TRUE horseman should be temperate in eating and drinking. If he cannot support thirst he never will make a warrior; he is like a frog in a swamp.

Buy a good horse, because when you pursue you will catch the fugitive, and when you are pursued the eye will not be able to say where you are gone.

Give preference to the horse of the mountain over the horse from the plain, and prefer the latter to that of the marshy land, which is only good for carrying burdens.

When you have bought a horse, study it with care, feed it gradually with barley until you have ascertained the exact quantity which its appetite demands. A good horseman should know the exact quantity of food which is most convenient for his horse, as well as he must know the exact charge of powder for his gun.

Never allow your dogs or your asses to lay down upon the straw or barley which is to be used as food for your horse.

The prophet said, "Every kernel of barley given to your horse is worth an indulgence in the other world."

Give the last kernel of barley to your horse, even if you have to deprive yourself of it; because Sidi Hamed-ben-Yousseuf has said, "If I had not seen horses produce horses, I would say it is barley;" he said further, "Barley is more powerful than spurs."

Do not water your horses but once a day, one or two hours after mid-day, and feed them with barley at sunset; that is a good practice in war, and besides it is the best way to make the flesh of the horse firm and hard.

To make a fat horse undergo and stand the fatigues of war, ride it until it loses flesh; never attempt to make him thin by reducing his rations. Never place your horse near others that are feeding on barley without giving it barley also. Never give it water after feeding barley—that would kill your horse.

Never water your horse after racing, you hazard his life. After a race or hard ride, when you wish to water your horse do it with the bridle on, feed it with a tight girth, and you will find that your horse will do well by it.

Keep yourself clean, and make your ablutions before you mount the horse. The prophet will love you.

He who commits a sin upon the back of his horse, is not worth the possession of it; he will be wounded, and finally punished.

When you run your horse, keep it back, so that you can use his fire when it is most required. You must use it like a skin filled with water; open it gradually, and keep the opening tight, you can easily then preserve the water, but if you open it briskly the water escapes at once, and nothing is left to quench your thirst with.

A good horseman should never run his horse up or down hill, except when he is obliged to do so. On the contrary he should always slacken

his gait. When you ask a horse which he loves best, to go up or down hill, he will answer, "May God curse the point where they meet."

When you have a long course before you, manage your horse in such a way that it can now and then take breath, keep up the change of gait until it has perspired and got dry again, allow it to urinate, draw your girth tighter, and you can then do as you please, your horse will never leave you in any difficulty.

When you are on the road and the wind blows heavily against you, change your line of march, if it is possible, in order to avoid the wind and prevent your horse from getting sick.

When your horse is going at full gallop and some other rider follows you, keep your horse quiet and do not excite it, because it will get excited without your urging it.

When you pursue an enemy, and you observe that he forces his horse, keep yours back, and you will be sure to overtake him.

After you have been a long time among narrow passes of a mountainous country and having emerged upon the plains, you will do well to gallop your horse.

In starting, the horseman should always allow his horse to play and gambol for a few minutes in order to free it from stiffness, and the horse will be easy for the whole day. After a hard and fatiguing ride, when you approach the tents of your people, let your horse dance and gambol a little. The women of the tents will applaud and will say, "Here is such a one, son of such a one," and you will learn the exact value of your horse.

The man who does not give a good gait to his horse, is not a horseman, and ought to be pitied.

The rider who can but does not allow his horse to urinate, commits a sin. His companions should stop him, it is a meritorious act.

In war or chase, should it happen that you have to swim your horse across a stream, be not frightened when he swallows seven or eight mouthfuls of water; that will not injure him in the least, he will continue his course with all safety. After a long course, you must either unsaddle him at once and throw cold water upon his back, or you must leave him saddled until he is perfectly dry and has eaten some barley, but always use the precaution to walk it all the time. There should be no mean between these two modes of practice.

After a long journey on a rainy or cold winter day, cover your horse immediately after you have reached your tent, give it roasted barley, warm milk, and do not allow it to have any water for that day. Never let your horse run on a hot summer day. Remember what their sires said, "Do not let me run in summer if you wish that I should save your life on a day of battle."

In case of life or death, should you observe that your horse is tired, let him have the bridle, and give him with the spurs a very vigorous thrust, so that it will bleed; the horse will urinate, and may save you yet.

When you rest your horse after a hard race, you can run it again when the mucus has ceased to flow from its nose.

Do you desire to ascertain the strength of your horse, after a day of fatigue, dismount and pull it by its tail towards you; does it resist without being moved from its stand, you can depend upon it. In expeditions, after

great fatigue, when you have only a few moments to rest, take for your pillow the bridles of your brothers, you will never be left behind or forgotten.

A horseman should study the habits of his horse and try to understand him thoroughly; he must know when he puts the foot upon the ground that he can rely upon his horse, that he will be quiet among the mares, or that he is obliged to fasten and watch him. These details are of importance in the presence of an enemy.

TRAINING THE ARABIAN HORSE.

The Arabs are in the habit of sending the colts with the mares to the pasture soon after they have been weaned; this is considered for colts as indispensable to the proper development of all their powers. In the evening when they return home, they lay themselves near the tents of their masters; women and children play with them; all kind of attention is paid to them; they are fed with bread, flour, milk, and dates. Being continually in company with the members of the family, the colt becomes very gentle, and forms that attachment to man which is so much admired and commented upon by travellers in the East. It happens very often that colts cut their tushes at the age of twelve months; they grow poor in consequence of it, eat little, and would perish if their tushes were not removed; after they are pulled out, they soon gain their strength and health again.

When colts of the age of fifteen or eighteen months do not show the proper freedom in their shoulders, the Arab never hesitates to apply fire (or the actual cautery) to the scapulo-humeral articulation. A cross is marked upon that point with tar or chalk, according to the colors of the horse; a circle is described around in a manner, that the extreme points of the cross are confined within it: to this figure the fire is applied.

In cases where the knees of the colts are badly turned, when there is a disposition for tumors or swellings, fire is applied upon three parallel lines near or at the place of disease.

If there is an indication that the colt is going to be straight in the hind or fore part, fire is applied to the large pastern, but only upon the anterior parts, proving that the Arabs are well acquainted with the seat of the tendons, and they are careful not to injure them. The fire is ordinarily applied with a *faucille.* The operation is generally performed during cool weather, in the latter part of autumn or in the beginning of spring, when flies are few and heat not oppressive. The proper time for commencing the training of colts is in their eighteenth month.

The Arabs begin thus early, because they know from experience that it is the only way to make a horse gentle; and it is particularly favorable to the development of the spleen, which the Arabs consider very important for the subsequent value of a good horse. The Arabs know full well that colts taken in training at a later period, will grow larger and stronger to the eye, but in reality they are less able to stand fatigue, and are less fit for long heats. "A hardened horse brings good luck, and God knows if the Arabian horse is hardened." The Arabian horse is kept in a continual motion, he accompanies his master everywhere, has to seek his own food, and has to walk great distances to obtain water, and this incessant activity makes him bear so much fatigue, and able to render at all times the services required of him. At eighteen or twenty months the colt is first backed by a child, who rides him to the water and pasture. A line or light bit is used, so as not to injure his mouth. That exercise is advantageous to both; the child practises riding, and the colt gets accustomed to carry a weight corre-

sponding to his strength ; it learns to walk properly and to see various objects that pass or approach him. The Arabians make their horses very gentle in that way, to be easily managed and not in the least restless. At that age the colt is accustomed to the fetters. In the commencement the fetters are made short, because without that precaution the young animal would lose its equilibrium, and hurt its chest or shoulders, or it may receive injury in lying down or getting up. The Arabian mode of fettering is without doubt the best and safest. The horse fettered thus is forced to bend forward whilst feeding, and it would seem as if the horse could not keep from falling, yet it never happens, from the fact that the Arabian horses are exceedingly well balanced, and of a firm foothold, having fine lines along the back and loins. With the Arabian fetters the horse is obliged to stretch its head and neck, making those parts more supple and free, and when it wants to lie down it has to place itself in the position of a dog stretched out to enjoy the sun. The colts are fettered around the tents, they are generally watched by a young negro, who has a long slender rod with which he chastises the colts every time they kick or bite. This is continued until the horse is perfectly gentle. When the colt is sent to the pasture it is always fettered. The fetters are placed either on the right or left side, a fore and hind foot is always fastened together, the ropes are kept rather short, to force it to keep its vertebral column straight, so that it grows more convex than concave. The advantages are lost when the rope is too long, because it allows the colt too much freedom. At the age of twenty-four to twenty-seven months the bridle and saddle exercises begin. Great precaution is used; the bridle is put on first and the curb generally enveloped with sheep's wool, the saline taste of which makes the colt to like it, which is indicated as soon as it begins to chew it. This exercise is practised for several days, always in the morning and in the evening; and when it is fairly accustomed to take the bridle, it is finally backed.

The autumn is the best time to back it—the flies are less troublesome, and the heat not so great. At the tents of some distinguished chiefs the colts are first practised with a basket filled with sand; they are used for a fortnight or more, until the horse learns to carry a heavier weight; at last a man backs him. About that time the colt has reached the thirtieth month. The vertebral column has acquired strength ; the young horse has become familiar with the fetters, saddle, and bridle, and it is now given into the hands of an experienced horseman, who treats it with the greatest care and kindness: he uses no spurs—a small rod is sufficient to correct its faults ; he rides it gently short distances, and gradually takes it to the next tent to see his friends, or look after his herds. His whole object is to make it obedient: should it show opposition, he talks to it in a quiet undertone; never gets excited—knowing that any resistance or harsh treatment will ruin the horse, and that it will lose that great virtue of an Arabian horse, "*the most perfect obedience.*" Poor people are obliged to use their colts earlier, before they reach their thirtieth month, but they are aware of the injury done to their horses; but necessity knows no laws or rules.

At the age of thirty months, the colts are practised in standing quiet when the rider has left the saddle. He teaches this by drawing the reins over its head, and letting them fall on the ground. A slave is placed near by, who watches the horse carefully, and in the moment it intends to start, he puts the foot upon the rein, which gives it a sudden shock, and after several days' practice, the horse begins to stand like a rock, and awaits its master for days. This is a very important part of the Arabian horsemanship, and is much practised in the Sahara, where, for instance, a horseman

has killed his antagonist, and he wants to secure the horse, he has only to throw the rein of the horse of his enemy upon the ground, and the horse is immovable like a statue; without this precaution, the horse would run away and join the tribe of his master. The colt is kept in regular practice in these lessons, until it has reached the third year, when it is taught to stand perfectly still; when the horseman wants to mount, the safety of his life depends on this kind of training. The lessons must be short, but continued until the horse stands firm and quiet. In these lessons the horseman is assisted by two men; one holding the reins, the other the stirrup. With gentle treatment and patience, the colt will soon learn to obey his master. The Arabs say that only such horses are restless under that lesson who are ailing and suffering from some cause, or are badly built.

From the third to the fourth year the horse is much used, but well fed. It is mounted with spurs; it is practised in its former lessons, and made more expert in them; it becomes more courageous, and is already free from fear; neither the noise from the various animals about the tents, nor that of the ferocious beasts which roam about in the night, or the report of the guns alarm it; and it is soon fit for the chase or war. Should there be a horse, which in spite of all careful management remains obstinate, either from laziness or malice, rears, bites, kicks, and is not willing to quit the tent or the company of other horses, and gets easily frightened,—such a horse must be brought to obedience by the force of spurs. They must be applied with energy and experience; long furrows must be drawn over the belly and flanks to inspire it with a perfect terror. It is only in a very few cases that such energetic punishment does not produce the desired effect; often after the first lesson the horse becomes gentle and obedient like a lamb, and follows his master like a dog. Horses which receive one such lesson, never require a second one. To sharpen the pain, salt or gunpowder is rubbed into the bleeding furrows. The Arabs are so much impressed with the efficacy of such a lesson, that they believe a horse is not regularly trained without having passed through this cruel ordeal. They consider such lessons with spurs, to be to a horse what the training collar is to a pointer or setter. Yet the expert Arabian horseman only uses the spurs to horses of a decided obstinate character. Generally a stick is used to chastise the horse, and it is applied pretty smartly upon the neck, behind the head piece of the bridle. Some put iron rings in the ears of obstinate horses, and especially such as are known to rear; every time the horse shows an inclination to rear, a blow upon the ring soon teaches him to leave off. The Arabs say spurs add one-fourth to the good horsemanship of a rider, and one-third to the vigor of the horse. They give the following fable as a proof of that saying: "When beasts were created they had a talk among themselves. The horse and camel swore never to fall out with each other; but, on the contrary, to keep always on good terms. One day it happened that an Arabian engaged in a feud, saw his camel take to its heels, and with it went all his fortune. He called at once for his horse—jumped on it, and forced him to start, but all efforts were without avail; the horse did not stir, remembering the promise he had made to his friend the camel. The Arab at last applied his terrible spurs: the horse, enraged with pain, reared, plunged, and soon reached the fugitive. 'Oh, thou traitor!' called out the camel, as the horse approached; 'thou hast perjured thyself: thou hast sworn never to harm me, and now you force me back again in the power of that tyrant.' 'Do not accuse my heart, for such a crime,' replied the horse; 'I did not want to injure you; but the thorns of misery made me to follow your steps.'" It is not easy to use the Arabian

spurs with the proper effect. The horsemen who possess that talent are noted: some of them know how to push the horse on, by tickling it continually with the spurs on the sides without wounding it; others again know only how to make a constant noise by striking against the stirrups, and exciting the animal in that way. Only those are considered the most expert in the use of spurs who understand how to make those bleeding furrows, which we mentioned above. When it is said that a horseman can take the sides of a horse from the navel to the vertebral column, it means that he understands the art to the highest degree of perfection. How often have I heard the Arabs exclaim, in praise of their Emir, "Abd-el-Kader crosses his spurs upon the loins of his horse!"

The spurs are very dangerous with an inexperienced horseman, because he may strike a horse in a joint, and lame it forever. Should the horse fall, the spurs could injure it very dangerously. The Arabs keep therefore the straps of their spurs always loose, so that they can move somewhat in case they are brought awkwardly against some parts of the horse. In case a horse is killed under his rider, the spurs are also much more easily slipped off when kept loose upon his foot, and allow the horseman to fly on foot and save his head. This is the reason why the Arabs use slippers in preference to boots.

The Arabs consider European spurs as entirely insufficient and useless. They say, "What effect can you produce with your spurs in case of life or death, when your horse is already worn out with fatigue? Your spurs are only good for tickling—to make him restless; but to get the last spark of fire from him, to save your head in case of emergency, our spurs are the thing."

The Arabian horseman manages himself the entire education of his horse. In the Sahara, horsemanship is taught by practice, tradition, and example. The name of a good horseman is only acquired by many and repeated proofs of great skill. To reach that reputation, it is not sufficient to know how to lead a horse over even ground, but he must be able to use his gun with great address; also in timbered, broken, and rough ground. Such an expert rider is called a rifle horseman, in distinction from that of the spur horseman. Should a horseman unite both qualifications, he is considered the beau ideal of a rider. They make even a difference between a horseman who knows how to get well over dry ground, and one who leads his horse courageously over slippery ground; the one is called the horseman of summer and the other of winter.

The Arabs, when they begin first to try their colts in racing, ride them on even ground; they use the stick and spurs to bring it into full speed; the heats are always short. Afterwards he tries it with an older horse of some repute, which animates the colt to keep up with the older horse. These trials are not without danger; but they believe that the guardian angel watches over the horseman, saying, "The angels have two special missions upon the world: one to preside at the races of horses, and the other at the union of man and wife. It is their calling to protect the horseman and his horse from evil, and to watch over the conception of the latter for a happy result."

To teach the horse in stopping suddenly, he rides against a wall, tree, man, or other objects, in full speed, and stops short when near it. When it has acquired some perfection in this exercise, he rides it at full speed to the brink of a precipice, or on the shore of a river. This is a very important part in breaking horses for warfare, chase, &c. When the young horse is not yet entirely at the command of the rider, when it hesitates or re-

fuses to separate itself from other horses, it is at once subjected to the following lesson: Some friends assist and place themselves in two ranges opposite each other, at two or three paces distant—the horse is forced to pass between the two ranges of horsemen. As soon as it stops, the horseman next to it strikes it with a rod, and at the same time the rider applies the spurs with vigor. In a fortnight's time, the most stubborn horse is perfectly broken and obedient as a lamb. The exercise of turning consists in turning the head of the horse quietly and briskly either to the right or left, but generally to the left. After the horseman has discharged his gun, he strikes with his hand the neck of his horse, and it turns to the left. After some practice it turns at the inclination of the body of the rider. Another important exercise is to start the horse from perfect rest into a full gallop. Distinguished Arabian horsemen are not content with the various exercises mentioned above. Some of them teach their horses extraordinary feats to shine at festivals, or other public exhibitions. For instance, he teaches the horse to jump at the horse of his enemy and bite it. Horses broken in that way have very often unhorsed the enemy. The horses are also taught to accelerate the gait of camels by biting their legs, as the shepherd dogs pinch the sheep. He teaches him also to walk on its hind legs like a dog. A great feat is to make the horse jump from the ground with its four feet at once—the rider generally throws at the same moment his rifle in the air and catches it very skilfully. Some break their horses to kneel down: this lesson is commenced whilst the horses are young. The attendants of the colts teach them to bend the knee by tickling it at the crown of the hoof and pinching it at the same time in the joint, and force it gradually to kneel. The horseman effects the same by touching it gently with the sides of the spurs above the knee. This is considered the ne plus ultra of horsemanship, and is the great delight of the women, who applaud and cheer the skilful performer. Besides this lesson, the horse is also broken for the games, which are practised at all religious and social festivals. The game of the girdle is very popular: the horse is started in full gallop, and the expert horseman lifts from the ground a girdle or scarf. Some more expert ones take two or more of them in one race placed at different points.

In the rifle game the Saharians are very expert: they use a large stone, or the shoulder-plate of a sheep, as target. The horse is started at some distance to get into a full gallop, and when it is at fifty or sixty paces the horseman fires at the mark. They are well practised in that exercise, and kill a gazelle or ostrich with much certainty.

The Arabs know only two kinds of gaits—the gallop and the pace: the trot they consider as useless and injurious to the horse. The great care and kindness with which the Arabs treat their horses, is not only from interest, but from religious feeling.

The Prophet said unto them: "The true believer who has broken his horse in such a manner as to distinguish himself in the holy wars—the sweat, the hair, the dung, and urine of such a horse will go into the balance of good, for the benefit of its master at the day of the last judgment." Notwithstanding all those ties which unite the Arab to the horse, notwithstanding the attachment formed between him and his horse, be it from habit, interest, or religion, the Mohammedan never gives his horse the name of a *human being*. He would consider it a sin to call a horse by the name of a saint. Horses of merit are called, for instance, "Happiness," "My fortune," "Gazelle," "Ostrich," "Coral," "Future," &c., &c. Similar names are given to the slaves.

It is a common practice among the Arabs to cut the hair of the foretop, of the tail, and mane. They have certain rules and objects for doing so. They cut, for instance, all the hair off a colt twelve months old, having only a small bunch on the top of his head, and the withers, and at the root of the tail. At the second and third year all the hair is cut and shaved off. From the third and fourth year they let the hair grow, until the colt has reached its fifth year, when they cut and shave them again. This is the last time that the hair is cut: it is left to grow now, and it would be considered a crime to touch it any more, because it could only be done with the view to make the horse appear younger, and cheat the purchaser. Every time the hair is cut, the place shorn or shaved is rubbed with an ointment made of sheep's dung and milk, or of Prussian blue and hot butter. These ointments soften the skin, and it makes the hair grow thicker. This singular custom of cutting and shaving the hair off has two objects. Firstly, to make the age of the horse known at the first glance up to the eighth year, because it requires three years before the hair has obtained its full growth again. Secondly, to harden it to the sting of flies; and, finally, to make the hair thicker, longer, and more silky in appearance and to the touch. The Arabs ridicule exceedingly the English fashion of mutilating the horse by cutting off half of its tail, and not without reason.

NOTE.—What a contrast between the Arab and the Christian horse trader! Instead of proclaiming their age, the Christian resorts to every kind of trick, even to the filling of teeth, dyeing of hair, and insertion of tails, to make horses appear young, and deceive the purchaser.

THE CONSTANTIA VINEYARDS AT THE CAPE OF GOOD HOPE.

IN the year 1650, when the Dutch first took possession of the Cape of Good Hope,* that country, now so fertile, was an entire wilderness, here and there covered with shrubs and a few scattered trees. The greatest portion of the land near the coast was an unproductive barren sand plain. The Dutch found, however, the climate very favorable to all kinds of plants, and in course of time introduced a great number of European agricultural plants and fruits, among which the grape-vine was not forgotten, and which seemed to flourish beyond all expectation. The grapes were abundant, and exceedingly rich in juice, but the wine produced from them had an unpleasant earthy taste, which increased when manure was applied to the vines. This was very discouraging to the vine-dressers of the Cape, and its culture was almost abandoned, until the settlements advanced in the valleys of the mountain region, when not only the earthy taste of the wine disappeared, but a wine was produced which is unrivalled even by the most celebrated productions of the old vine-growing regions of Europe.

Professor Ferdinand Krauss, of the Royal Museum of Wirtemberg, with whom I became acquainted during my stay at Stuttgart, lived for several ears at the Cape, collecting specimens for the Royal Cabinet of Natural History; he was an intimate friend of the present proprietor of the Groot and Kleen Constantia vineyards, which the Professor visited very often, taking much interest in the management of those celebrated spots, coming, as he did, from a vine-growing district himself. He examined the soil, and collected many interesting facts, which he brought to the notice of the

* The Cape of Good Hope lies under the 35° Lat. S., and 16° 3′ Lon. E.

agriculturists of Germany, at the convention held at Stuttgart in the year 1842, from which the following account is mostly taken:

Professor Krauss brought with him from the Cape the principal grapes raised there, and had them preserved in jars, which he had the kindness to show to me, and I had the pleasure to find that the preserved Pontac, from which the best Cape wine is made, corresponded with the drawings of that grape in my collection of grapes, which came originally from France.

Upon the eastern side of the mountain range which crosses the Peninsula from the Table mountain to the proper Cape of Good Hope, there rises the Constantia mountain, at the foot of which the celebrated vineyards and settlements of *Groot* and *Kleen Constantia* are situated.

William Adrian Van der Stell, who was the Dutch governor from the year 1699 until 1707, planted the first vines at Groot Constantia, named after his daughter. He was the first who introduced white Muscatel and Pontac cuttings from the south of Europe, of which, at the present time, many a healthy vine can still be seen. In the year 1778, Henry Cloete, the grandfather of the present proprietor of these famous vineyards, purchased them for £1500; he enlarged and improved them considerably. In the year 1784 he imported from the south of France the first Frontignac vines, and cultivated them with such success, that in the third year after planting he produced good wine from their grapes. His heirs continued to improve the land; and Jacob Cloete, the present owner, takes good care to preserve the reputation and celebrity of the Constantia growth. Mr. Cloete ascribes the fine aroma and extraordinary qualities of his wines, not to the peculiar or better kind of vines, or to a secret in the management of the vine, but mostly to the peculiar nature of the soil, which is forcibly illustrated by the adjacent vineyards, where the same kind of vines are cultivated, and treated in the same manner as those in the vineyards of Mr. Cloete, yet his neighbors are not able to produce a wine like the Constantia. They endeavored, through a judicious mixture of soil and manure, to improve their vineyards, but nevertheless the results were not satisfactory. Experiments of the same kind have been made in other districts of the Cape, as, for instance, on the Tiger mountain, Drackenstein, and on the eastern shore of the Olifant river, with the view of growing Constantia vines. The wines from those districts are sweet and pleasant, and are sold in Europe for Constantia, but they cannot stand comparison with the genuine growth of the Constantia vineyards.

The Constantia mountain rises 2000 feet above the level of the sea; the foot of the mountain consists of a coarse-grained granite, mixed with large crystals of feldspar; upon the strata of the granite lies a colored sandstone rich in quartz, through which pass several veins of manganese ore.

The eastern acclivity of the mountain has many deep chasms, which are covered with trees and shrubs. The Constantia vineyards lie upon a granite hill, which is bordered on two sides by deep ravines. The soil of the vineyards consists not alone of decomposed granite, but it is mixed with fragments of colored sandstone, which, from various causes, have been carried down to lower portions of the mountain. From the proper mixture of these two principal geological formations the peculiarity of the composition must be ascribed. The best soil of the Constantia vineyards is of a yellowish color, and contains a great deal of the coarse grains of quartz. The large grains of quartz allow the rain (which falls abundantly during the rainy season) to penetrate easily into the subsoil, as in summer they assist in binding the soil firmly together, so as to form an impenetrable crust against the hot rays of the sun.

On examination it is proved that the soil contains, in some parts, more or

less clay or sand, that gives the soil a more or less whitish color. The Professor ascribes it to a strata of granite different in composition from the coarse-grained ore. In the adjacent vineyards he could trace the veins of decomposed *dolomite*, which pass through the granite in a similar manner as in the vicinity of Cape Town. In those places the soil is of a reddish brown color, fine like powder, but very unfavorable to the culture of the vine.

In the Constantia vineyards three different kinds of vines are cultivated, viz.:

1st. The red and white Muscatel with small elliptical bunches, but compact; the grape round, and very rich and juicy.

2d. The Frontignac, with elliptical bunches as big as a man's fist; the grape round, and of a light red color and very juicy.

3d. The Pontac, the bunches are compact, but only half the size of the others; the grapes are of a dark blue color, small, oval, and the juice is dark red. The veins of the vines are red, and the leaves are very downy.

Besides these there is also a vine cultivated called the Steen grape, its bunches are not very compact, the grapes are white, round, and small; it is not suited for the sweet wines, but is used for *champagne*, probably the Riesling from the Rhine. Of the first three vines mentioned above, the red and white Muscatel are more extensively cultivated than the other kinds.

The vineyards are laid out in a very simple manner. The land is spaded over to about two feet deep, and in the spring (September and October) the cuttings (18 inches in length) are planted in rows, four feet apart. In the second year, during the rainy season, the land is a little manured. The young vines bear, generally, in the second year after planting; and in the fourth year they are perfect in their development, and the grapes are now suitable for sweet wines.

Mr. Cloete assured the Professor that much attention and precision are required in the management of vineyards. According to the accounts of our reporter these vineyards are managed with great judgment, and the land is kept perfectly free from weeds: the work is performed not only in the right season and time, but with care. The vineyards are generally manured in the months of June and July. Those on poor soil are manured every second or third year; in good land, every eight or ten years. The manure is always applied in small quantities. In some portions, where the soil is of the very best quality, it is applied only every 18 years. Mr. Cloete observed that the grapes take the taste of the manure. He found that vines manured with fresh cow-dung yield grapes with a taste like the fertilizer: to prevent it, he uses only manure which has been previously mixed with leaves, and allowed to decompose before it is carried into the vineyards. The vines are trained low, and about the middle of July pruned down to three buds.

The vineyards with a poor soil, containing but little clay, are worked in the month of August; those with good soil, and a right proportion of clay, are worked about the beginning of the month of October. Some vine-dressers pretend, that when the lands are worked in the month of July the insects are more effectually destroyed. The insects are very numerous and injurious to the vines at the Cape, and during the months of September, October, and November, the children are regularly employed in cleaning the vines; every vine is carefully examined, and every insect removed. A kind of caterpillar, called Brochmannetje, destroys the buds; and another caterpillar, as well as a bug, (*Phlyctinus Callosus*, *Colander*), bore into the

young shoots and cut them entirely off; the latter are considered the most dangerous to vineyards.

In the beginning of November the vines blossom; the grapes ripen about the latter part of January, or in the beginning of February. To make sweet wine the grapes are left to get very ripe, until they are nearly half dry, upon the vine. To accelerate the ripening the leaves are removed, to allow the sun more access. About the latter part of March, or in the beginning of April, the vintage commences. The grapes are gathered only during fine weather, and about mid-day, when the dew has entirely disappeared. Each bunch is separately examined, and all rotten or spoiled grapes removed from it.

The operation of expressing the juice is carried on with much care and speed, because the must and the husks are liable to be influenced by the high temperature of that climate, which causes the loss of the pure and fine flavor. The grapes are placed in a vat and slightly trodden, to separate the stems from the grapes; the stems and mashed grapes are then put into a sieve made of the Spanish cane, and the grapes are forced through the meshes by hand, and the stems removed. They are next gathered into a vat, the bottom of which is perforated, and placed over another vat or vessel, which receives the must as it flows from the grapes; in this vat they are now thoroughly trodden. This is a very tiresome and fatiguing operation, because the grapes are already much dried up, and require greater power to mash them properly. The juice which is collected in the lower vat is again mixed with the husks, and the whole placed in a large cask, when the mass is well mixed and stirred up until the fermentation commences.

The fermentation begins sooner or later, according to the temperature of the atmosphere, sometimes on the second, sometimes about the eighth or tenth day. After the fermentation has set in, the mass must be kept quiet and undisturbed; and when it has lasted for about two days, the must is drawn off from the husks and placed in dry, well-sulphured casks: after eight or ten days, when the fermentation has ceased, the must is again drawn off, and placed in another thoroughly-sulphured cask.

In the manufacture of sweet wines, the principal object is to stop the fermentation as quick and as perfectly as possible. Mr. Cloete accomplishes this in the following manner. He puts into each cask of 152 gallons six or eight buckets full of wine; the cask is then sulphured, well bunged down, and rolled and moved about until the smell of sulphur has entirely disappeared; this is generally accomplished in about two or four hours' time, and the cask is ready to receive the charge. The cask must be examined every day, and if the fermentation has again commenced, the wine is drawn off at once into another cask, which has been well sulphured and managed as stated above. But in all instances the wine must be drawn off every six weeks after the first sulphuring, in order to keep it always clear and fine. During the first year the wine requires at least every month a change of casks. Wine managed in this way can be brought into market after the second year, but it is much better to use it in the third or sixth year. The Constantia wine is not for long keeping, it gets ropy and oily. These wines are kept best in airy, clean cellars, above ground. This is the management of the wine from the Groot Constantia, the oldest vineyard, which yields the best product. Kleen Constantia is of more modern date, and is in possession of the brother of Mr. Cloete. There are two other vineyards joining Groot Constantia; one of them is called High Constantia, belonging to Mr. Van Reeken.

The prices of the sweet Constantia wines have much increased in the course of time. The grandfather of the present proprietors sold, in the year 1780, half an Aam = 19 gallons of the white and red wine, at £2 18*s.* 6*d.*, of the Frontignac and Pontac, £3 10*s.*; the same quantity costs, since 1838, of the first sort, £15; of the latter sort, £18 10*s.*; the Pontac brought, in the year 1840, the enormous price of £22 10*s.* for the half an Aam.

During the months of November, December, and January, the roads in the vicinity of Capetown are crowded with teams and oxen bringing in wagon loads of wine, even from a distance of 200 or 300 miles.

The different wines made at the Cape are red and white Constantia, Frontignac, Pontac, Hock, sweet Muscatel, Steen Constantia, and Cape Madeira. Also a large quantity of raisins are made in the colony, and the dried fruits of the Cape are very celebrated.

The inhabitants of the Cape divide the year into two periods—the good and the bad monsoon. The first commences in September, and answers to our summer: during its continuance the S. E. winds prevail. These winds are of a dry and blasting sort, and destroy the foliage and blossoms of such fruit trees as are not sufficiently sheltered. The mornings, during this season, are in general hot and sultry; but the breeze springs up about mid-day, dying away towards evening, leaving the atmosphere cool and refreshing. The thermometer, in the hottest months, varies from 70° to 90°, but often remains for days at 83° or 84°, and has sometimes risen to 105° in the shade.

On the approach of winter the S. E. wind becomes less frequent and violent, and is at length succeeded by the N. W. wind, which is generally attended with thick fogs and heavy rains. The rain descends in torrents, sometimes for many days without the least interruption, particularly during the months of June and July.

It is not unusual for the thermometer to rise 30° in the course of five or six hours. The mean temperature of the winter months is 58°, of the summer months, 77°.

C. L. F., *Ed.*

SHEEPFOLD OF THE AGRICULTURAL SCHOOL AT HOHENHEIM, IN WIRTEMBERG.

The object of keeping sheep at the Agricultural School at Hohenheim. in Wirtemberg, is twofold: first, to supply the sheep-breeders of Wirtemberg with fine rams and ewes to breed from; and second, for the instruction of the pupils.

The flock is not very large, and numbers about eight hundred and fifty in all. It consists in—

1. *Electoral-sheep*, which were originally procured from Saxony. In the year 1846, two rams and four ewes were added from the Lichnowski Hennersdorf flock.

2. *Electoral-Justinger*, a cross with original Merino rams, obtained from Spain in the year 1780, and the common country sheep, which, since 1824, has been exclusively crossed with Electoral rams.

3. *Merino Comb-wool sheep.* This breed was commenced in the year 1830 with a select number of heavy-woolled Electoral-Justinger, and since 1843 it has been crossed with rams of the comb-wool flock of Count Schwerinat, Wolfshagen, in Uckermark.

4. *The English Merino Cross* was commenced in the year 1850. Merino ewes of a coarse wool were crossed with long-woolled Leicester, in order to

obtain sheep of a larger size, possessing greater fattening properties, and a long comb wool. The offspring of the first cross have been kept pure and without intermixture. Some have been crossed with fresh English blood, but as the wool did not answer the expectation, a rich and heavy-woolled *Merino Comb-wool ram* has been employed.

The principal aim in breeding at Hohenheim is to increase the quantity of wool and the size of the animals.

I had often occasion to examine these flocks, and found the *Electoral*, like their kindred, of a small size, with a tight skin and light fleece, but the wool fine and well stapled.

The *English Merinos* have a wool of about three inches and more in length: it is soft to the touch, very little curled, the staple open. I have raised many a sheep from crosses between common ewes and Merino rams, and their wool was as long, and even of a finer quality, than the above-named English Merinos.

The ewes are numbered by means of marks in the ear. The rams have the number burnt upon the horns. A regular register is kept, in which the character of the wool is inscribed, and the class marked to which the sheep belongs. The following is a copy of that register:

No.	Parents.			Character of the Wool.										Form and Size of Body.	Classification.	Remarks.
	Mother.		Father.		Interior of the Staple.											
	Number.	Descended from, and Quality.	Number.	Exterior of the Staple.	Regularity and Evenness.	Bows.	Growth and Character.	Length.	Density of the Fleece.	Fineness.	Softness.	Evenness.	Weight of Fleece.			

To facilitate the keeping of the above register, and to control the coupling register, a separate lamb register is kept, which is divided into the following columns: 1, The number of the ewe which is expected to produce a lamb; 2, the number of the ram with which the ewe has been coupled; 3, day of crossing; 4, day of birth of the lamb; 5, sex of the lamb; 6, number which has been given to the lamb. The lamb is numbered immediately after the birth, or in the first days whilst it is kept in a separate stall with the mother. After the first year, the yearlings are registered according to their sex. The columns of the character of the wool and clas-

sification are filled up at the yearly principal examination of the flock. It is preferable to describe the character of the wool of the ewes and to classify them at the time when they have their first lamb. Ewes and rams are used for breeding when two and a half years old. A ram generally serves for fifty to seventy-five ewes. Some years since the time for coupling was about the latter part of July, and lasted up to the last days of August, so that the time for lambing fell principally in the month of January. Of late, summer lambs have been found to be more advantageous. The experiments made at Hohenheim have shown that ewes are not so apt to take the ram in the winter as in summer; but the results proved so very favorably that the experiments were continued. The winter coupling-time is generally in January, and lasts until the middle of February. The ewes must be kept warm during that time, and must be fed for two or three weeks previously with potatoes and oats, to make them more eager for the ram. Whilst the ewes are lambing during the winter they lose their wool, or get wool of a weak kind. Those with summer lambs remain vigorous, and do not lose a single wool hair.

The washing of the pregnant ewes never affected a single one of them injuriously. Soon after the clip, they have the lambs in the fields and pastures, or at home during mid-day or in the night. In about ten days or a fortnight, the lambs go with their mothers upon the pastures. The milk of the ewe is very nourishing, and the lambs grow vigorously, and in the following spring they are as large as the winter lambs, five months older. The yield of wool is nearly as great as from yearlings, and can be made up in bundles and sold with the regular fleece wool.

The quantity of wool gained from summer lambs compared with that from winter lambs is as 74 to 64. Besides the greater gain on wool, the summer lambs develop themselves sooner and better, and are less liable to disease. During the transition from winter to summer lambing, a great many ewes remain unimpregnated; but after two or three years there is no greater number of such ewes than we find usually among ewes which have their lambs in winter. The time for pasturing commences about the 15th of April, and lasts till late in November—in all seven months. Five sheep are calculated to one morgen (about three quarters of our acre) of meadow. One sheep to one morgen of meadow, upon which the sheep are pastured early in the spring, and after the second crop of hay is taken. For fields under cultivation, one sheep to four morgen.

The time for wintering the sheep lasts five months. The sheep are fed with hay, sliced raw potatoes, sometimes beets and straw. Potatoes are not injurious to sheep which have been accustomed to them at an early age, provided that only half of the equivalent of hay is given in potatoes, and that the ewes are uniformly fed with them before and after lambing. The mode of feeding is the following:

A ewe before lambing receives $1\frac{1}{2}$ lb. of hay, 2 lbs. of potatoes, and 1 lb. of straw. A ewe with a lamb, $1\frac{3}{4}$ lbs. of hay, 2 lbs. of potatoes, and 1 lb. of straw. Yearlings, $1\frac{1}{4}$ lbs. of hay, 2 lbs. of potatoes, and $\frac{3}{4}$ lb. of straw. For a ram, $1\frac{3}{4}$ lbs. of hay, 2 lbs. of potatoes, and $\frac{3}{4}$ lb. of straw. The rules of feeding are: In the morning the sheep are fed with hay; they are then watered; at ten o'clock A. M., with potatoes; at noon with hay, and watered; in the afternoon, at three o'clock, with potatoes; and in the evening, with straw.

Once a week they get salt, in the evening; 2 lbs. a year are calculated per head.

The lambs are kept in the beginning, every one in a separate stall with

its mother, till the mother knows the lamb and the lamb the mother, and till she allows the lamb to suckle freely; they are then brought into larger divisions; after four weeks, the lambs are separated for two or three hours during the day from their mothers, and continually somewhat longer until they are only allowed to be with them during mid-day and night. The lambs are then fed with hay and oats; after four months, they are entirely separated from their mothers. When the lambs are about four weeks old, the surplus ram-lambs are castrated. The washing and shearing are done in the beginning of June; they are washed under a shower-bath. The evening before the washing commences, the sheep are driven into a pond to be soaked, and are kept overnight in the stable. The next morning they are driven into the pond again, and in two or three hours afterwards washed as clean as possible under the shower-bath. The sheep, when dry, are examined and classified before they are shorn.

The fleece of every sheep is exactly weighed, and the weight registered. The separation of the inferior portion of the fleeces and putting them up in bundles is intrusted to experienced persons. According to the Shearing List of 1850 before us:

1. The ewes of the Electoral breed were 322 in number; each received $2\frac{1}{2}$ lbs. of hay, or its equivalent, per day, and yielded in wool $2\frac{1}{3}$ lbs.; worth $1.40.

2. The ewes of the Merino Comb-wool breed, 226 in number; each received 2·75 lbs. of hay, or its equivalent; yielded in wool 2·75 lbs.; worth $1.42.

3. The ewes of the English Merino breed, 31 in number; each received 2·75 lbs. of hay, or its equivalent, per day; yielded in wool $3\frac{1}{2}$ lbs.; worth $1.14.

The rams of the same breed as the ewes No. 1, 36 in number, each received daily 3 lbs. of hay, or its equivalent; yielded in wool 3 lbs.; worth $1.80.

The rams of breed No. 2, 46 in number, each received daily 3 lbs. of hay, or its equivalent; yielded 3·33 lbs. of wool; worth $1.75.

The rams of breed No. 3, 6 in number, each received daily 3·25 lbs. of hay; yielded in wool $3\frac{1}{2}$ lbs.; worth $1.30.

The wethers of the Electoral breed, 459 in number, each received daily $2\frac{1}{2}$ lbs. of hay, or its equivalent; yielded in wool 2·32 lbs.; worth $1.40.

The wethers of breed No. 2, 319 in number, each consumed $2\frac{3}{4}$ lbs. of hay, or its equivalent, and yielded in wool 2·75 lbs.; worth $1.46.

The English Merino wethers, 45 in number, each consumed daily 2·75 lbs. of hay; yielded in wool $3\frac{1}{3}$ lbs.; worth $1.32.

From the above we will observe that a Merino consumed, on an average, 2·75 lbs. of hay; yielded $2\frac{1}{3}$ lbs. of wool; worth, on an average, $1.50.

A Merino Comb-wool consumed, on an average, 2·83 lbs. of hay; yielded 2·94 lbs. of wool; worth $1.54.

An English Merino consumed, on an average, 2·92 lbs. of hay per day; yielded 3·45 lbs. of wool; worth, on an average, $1.25. And it shows further, that the Merinos consumed less hay, produced less wool, but of a superior quality, which brought a higher price, and repaid much better the food consumed than the sheep of the two other breeds.

C. L. F., *Ed.*

GUANO.

[From Professor Stockhardt's "Chemical Field Lectures," translated for the American Polytechnic Journal.]

LOCALITY AND CONSTITUENTS OF GUANO.

Guano consists of the dung of sea-fowls, which has been heaped up in the course of time in larger or smaller layers on uninhabited islands and cliffs.

Good guano is only to be found in those parts of the world in which it never or scarcely ever rains, and on those islands which are high enough not to be washed by the sea, for in the opposite case, the best and most efficacious portions of the guano become dissolved and carried off by the water. If a dunghill be left to lie in the open air for some years, so that the sun may shine on it, the air penetrate it, and the rain wash it out, what will remain of it at the end? not much more than some earthy mineral substances which cannot be dissolved or evaporated. Such kinds of poor guano that have been lixiviated by rain or other means, are often met with in commerce, and the farmer should be on his guard against them. These belong to the cargoes which come from Chili and Patagonia, as rains are very frequent in those countries. The kinds which we meet with now under the name of "African Guano" are likewise of this description, while the guano which for a couple of years has been brought from Africa, which bears the name of Schabo or Ichaboe, cannot be regarded as a good kind of guano.

The best guano comes from the part of Peru where it rains very rarely, and which lies between 5° to 20° of south latitude. It here covers the rocky surface of the cliffs and islands in layers of very different thickness. The thickness of these layers varies from one or several yards to twenty or thirty yards or more. In the first years when a layer of guano has been deposited, it has a white color and is called White Guano (*guano blanco*); this is regarded as the best, and is estimated by the Peruvians, who particularly value it, higher than the brown. It has about the same constituents and the same efficacy as our doves' dung, only it acts more energetically, because it is richer in substances containing nitrogen than the latter. The reason of this difference is in the difference of the food of the birds. The sea-fowl, the excrements of which furnish the guano, live on fishes, while the pigeons or doves live on vegetable food; but flesh is always richer in nitrogen, and on this account furnishes a dung richer in nitrogen than vegetable food. The layers which succeed to the white guano, have a clear brown color, still deeper down it becomes darker, and at the bottom rust color; the lower layers too are always more compact than the upper. It is evident that the lowest layers are the oldest; in them the putrefying decomposition has gone the furthest, and therefore in the lowest layers there are not to be found any feathers, egg-shells, and other remains, while in the upper layers they are very frequent.

But may not these layers of good guano be soon exhausted in the increasing need of it? This apprehension has been expressed by many farmers; but they need not be anxious on this point. According to the estimates lately made by the Peruvian government, the layers of guano found in Southern and Central Peru will furnish a supply of more than 500 millions cwt. This supply must therefore last for some time.

But this apprehension, that there may be an end to guano, should have the effect to spur up the farmers to share in the advantages which rational husbandry may derive from it before it is too late. For it is incontestable that those countries which first lay hold of it will reap the greatest advan-

tage, as they will the sooner increase the value of their lands than those which come into its use later, and the former will thus reach sooner the point at which they can dispense with guano. This point will be reached, when by the use of guano such an amount of fodder and straw is attained as will enable the farmer to produce as much stable manure as is required for the enriching the whole extent of his lands. In Saxony and Upper Lausitz there are already many such farms, which employ guano with the view of producing hereafter the necessary amount of manure from their domestic cattle, by means of an increased product.

The kinds of guano at present found in commerce are brought from South America and Africa. The South American under the names of Guano of Peru, Bolivia, Chili, Sea Island, and Patagonia; the African under the same names, or of the Cape and Saldanha Bay Guano. Of these varieties, only the *Peruvian Guano* is regarded as *good* guano; all the other kinds are less rich, and more or less washed out.

Till within a few years, as already mentioned, a tolerably good kind was brought from Africa, which bore the name of Schabo or Ichaboe, and was distinguished by a very dark brownish black color. This sort has ceased, as according to certain statements the layers have been wholly exhausted since two years; it may therefore be omitted here.

The names are patent, they can at pleasure be fixed on this or that article: therefore there is no reliance as to the name given in commerce. In order to obtain a sure standard for judging of the goodness of different sorts of guano, we must know of *what constituents* they are composed, and in *what quantity* the more important elements are to be found. What a remarkable difference there is in this respect will be evident from the following analyses of those kinds of guano which have been brought into Saxony for the last few years. The quantity analyzed is 100 lbs.

Constituent Parts.	No. 1. Guano of Peru. 1850.	No. 2. Guano of Peru. 1851.	No. 3. Guano of Saldanha. 1847.	No. 4. Guano of Chili. 1848.	No. 5. Guano of Patagonia. 1850.	No. 6. New Guano of Africa. 1850.
Moisture	10	8	8	20	6	15
Combustible or volatile substances containing nitrogen	59	65	22	11	15	13
Phosphate of lime	25	22	64	51	77	53
Alkaline salts	3	4	..	..	..	..
Salts of soda	1	..	1	13	..	..
Gypsum	..	..	..	2	..	13
Silicious earth, sand, stones, &c.	2	1	5	3	2	6
Total Quantity	100	100	100	100	100	100
Nitrogen in 100 lbs.	12 3-4	13 1-2	1 3-4	3-4	1 1-4	9-10
Value per 100 lbs., reckoned according to the constituent parts.	$2.42	2.52	0.96	0.80	1.00	0.72
Present price in trade of 100 lbs.	2.75	2.75	1.80–2	1.80–2	1.80–2	1.80–2

Likewise the *white lumps* are differently compounded, which are often found in good as well as in bad kinds of guano, as the following table of their principal parts shows, that 100 lbs. of lumps contain:

Constituent Parts.	Guano of Peru, No. 1.	Patagonian Guano, No. 5.	Guano of Africa, No. 6.
Combustible substances	74	13	14
Nitrogen	15 1-4	7-8	1
Phosphate of lime	16	68	30
Gypsum	..	3	41

A kind of *adulterated guano*, which two years since came hither from England, contains only 7 per cent. of combustible substances, with $\frac{2}{5}$ nitrogen, and 89 per cent. of ash (of yellowish red color), in which were contained 72 per cent. of silicious earth, sand, clay, and stones. One part of Peruvian guano has been mixed with six or seven times as much clay and sand. Another cargo which first reached Hamburg this spring from England, to be sold as good guano to the good-natured Germans, consisted of one-third of good Peruvian guano and two-thirds of fine sand; it also yielded on being burned brownish red ashes.

Of the given constituents of guano, *nitrogen* is regarded as by far the most valuable one, for this it is which imparts to it its wondrously *strong exciting* power, for which it is so highly prized and paid for. In the fresh excrements of fowls, nitrogen is principally to be found in the form of uric acid, just as in the urine of cattle, sheep, &c.; in putrefied fowl dung, on the contrary, such as we have in guano, the uric acid such as exists in putrefied or stale urine has already been converted into *ammonia*, or more correctly ammoniacal salts, which are easily soluble and digestible by plants. We must regard guano therefore as a perfectly fomented manure, as a *decomposed liquid dung in a more solid form*, and to this circumstance is to be ascribed that it is so *rapid* in its effects whenever it is applied to moist soil.

In good guano nearly half consists of ammoniacal salts, while the bad kinds often only give traces of them. At present, notwithstanding the high price, guano is the *cheapest source of ammonia* for the farmer, for the pound is only 15 cents, or one pound of nitrogen at 18 cents, while the ammoniacal salts of commerce cannot be procured at the cheapest rate at less than from 30 to 33 cents. As long therefore as the field can by ammonia attain to a higher degree of fruitfulness, and so long as we possess no cheaper source of ammonia, so long also must guano be used with advantage as a mighty aid to agriculture.

In the common temperature the ammoniacal salts contained in guano are not volatile, because the acids which it contains, which are likewise generated by the rotting of the bird dung (humic and oxalic acids, &c.), operate to fix the ammonia as well as the sulphuric acid. We need not then fear that guano will sensibly lose its power by being kept. On being heated, on the contrary, it loses much of its fertilizing power.

Next to nitrogen or ammonia, the *phosphoric acid* is considered the most valuable constituent of guano. It is always found in guano combined with lime, and therefore in analyzing it is generally set down as *phosphate of lime*. This lime remains, when guano is heated, in the form of ashes, as it is not thus burned or dissipated. The more phosphate of lime (ashes) and the less ammoniacal salts (combustible substances) guano contains, so much the lower must its value be put down. Good Peruvian guano contains about one-fourth to one-third of phosphate of lime; the poor lixiviated (African, Patagonian, &c.), on the contrary, three-fourths to four-fifths. We find the opinion frequently asserted, that the excellent effect of guano is principally to be ascribed to the phosphate of lime contained in it; but the guano itself contradicts this opinion in the most decisive manner, for if it were correct, then must the bad guano effect much more than the good, as it contains two or three times as much more phosphate of lime. But it does not so prove, as hundreds of experiments made by farmers in Saxony show, who in order to spare a few cents in buying a good article, used the Patagonian or African kinds of guano.

The other constituents of guano, Alkaline Salts, Salts of Soda (Glauber Salts, Common Salt, &c.), and Gypsum, existing in guano, are only to be

found in such small quantities, that they may be passed over in the analysis of guano for agricultural practice. The two last only deserve a closer consideration when they are found in large quantities, for in this case, because of their lower price, they must be regarded as a *means of deterioration* of guano. The kind under No. 4 must be regarded as such a guano, adulterated by salts of soda; and as one adulterated by gypsum, the kind under No. 6.

EFFECT AND USE OF GUANO.

On account of its great proportion of nitrogen, *i. e.* ammonia, the good guano is to be regarded as the most *exciting* and *rapidly effective* manure which is at the command of the farmer. For this reason, it is above all others the best for *auxiliary manuring*. The farmer has in it an admirable means of *improving the usual stable dung* and raising its fertilizing power. Stable dung is poor in nitrogen, for one cart-load contains hardly more of it than half a hundred weight of guano. But this nitrogen is not yet in a state to be taken up by plants, for it is not, or but a small portion of it, in a proper state for nourishing plants; it will be so after it lies in the earth. A small addition of guano can here effect wonders, for young plants derive their nutriment from it till that from the stable manure is ready to be taken up by them; they can therefore grow more strongly and rapidly at the outset, and the farmer may in this way obtain *vigorous* young plants.

Another advantage, which goes hand in hand with this, is, that unfavorable circumstances of the weather and climatic influences operate less injuriously on such crops, for it is natural that a powerful plant will be less harmed in such circumstances than a weak one. Saxon farmers as well as English have often made the observation, that the crops manured with guano, are less exposed to attacks of insects than others. Potatoes manured with guano are rarely attacked by the maggot, and likewise rape fields manured the previous autumn with guano were less injured by snails, while other fields were greatly ravaged by them.

Whether this mode of applying the guano with the stable dung be carried on at the same time, or put in with the seed, or strewed over the seed already sprung up, is immaterial, if it be only used in time, so that the plants can make full use of it.

The farmer must use guano as the physician does Peruvian bark or quinine, as a tonic or means of giving strength, so to aid crops of all kinds which have suffered by the winter, or have been kept back in their growth from want of strength in the soil or any other cause. Such crops are to be strewed over in the spring, or before they shoot up, according to their condition, with one and a half to two hundred weight of guano for an acre, and may in all cases depend on excellent success, especially in winter wheat, because its vegetation in the spring is slow. The excess of growth which is obtained thus by guano, after deducting its cost, must of course be regarded as the *increased net product;* for the cost of planting, the interest of the land, industrial capital, taxes, &c., are to be put to the account of the produce which we might have obtained without manuring with guano, and would be the same even if the increased product had not existed. By such an aid with guano, we are also in a condition so to strengthen some poor spots of the crop, that the whole field will be converted into a very uniform beautiful crop.

Used in this way, even a farmer who possesses sufficient stable manure may yet derive advantage from guano, for among his usual manures he has none which operates with equal quickness and can be applied so conveni-

ently as guano. Old compost heaps, often times drenched with urine, come nearest to the effect of guano.

As good guano consists of rotted excrements, in which the manuring ingredients, the combustible or organic ones, as well as the incombustible or mineral ones, are all existing, it can therefore be as well employed as *solely dung* material, like rotted stable manure, and indeed in all cases has a decided preference over the latter, where the aim is to secure a quick and powerful effect. Guano affords the greatest advantage for the oil fruits of every kind—rape, &c., likewise for potatoes; it is especially well suited for wheat and rye, and next barley, vetches, and peas, and finally to oats. The diminished profit when applied to the latter is by no means, however, so great that guano cannot be used with advantage. But particularly guano is extremely useful and profitable for vegetables, beets, grats, and garden plants of all kinds; for example, as celery, carrots, cabbages, artichokes, &c.

In its application to oil crops, guano shows itself the more profitable, because these, as first crops, do not lay down, even when manured to excess, and leave the soil in such a state of fertility, that wheat or rye succeed excellently after them. The remarkable extension these crops have had the last ten years in Saxony, is mainly to be ascribed to this manure. Their culture has been made possible on the Erz mountains to the height of above 2000 feet above the level of the sea. With the aid of guano, summer oil-crops are cultivated in a far more extensive manner in the most mountainous regions, than was formerly the case. As this crop needs only a short time to ripen, and is easily sold immediately after the gathering, the money used in manuring is repaid with the profits in about three months, and the field is likewise fully prepared for the reception of the winter crops, which, without any additional manuring, yields an excellent crop. In the mountainous regions of Saxony, guano yields a yet more special advantage in planting winter rye upon grass land, newly turned, after it has been mown for one or more years in grass, which when the soil is not too heavy and binding, gives an uncommonly good yield, and proves very advantageous. Formerly the extent of a winter crop after grass depended on the quantity of dung that could be brought together; with the help, however, of guano, one may now give it any extent.

It would occupy too much space for this essay to state the various experiments made in Saxony, where guano has proved to be profitable *for all kinds of crops*, and in *all sorts of soils*. It is sufficient to say that according to them one hundred weight of guano in the *first* year caused a product of 540 pounds of rye, 600 to 800 pounds of barley, or 320 to 330 pounds of potatoes. If we calculate the effects as fertilizers afterwards, it may be assumed that one hundred weight of guano in the circumstances produced at least 800 pounds of rye with the corresponding amount of straw, of at least 1800 pounds, of which some 60 per cent. may be reckoned for the first, 25 per cent. for the second, and 15 per cent. for the third year.

The quantity of 30,000 cwt. of guano, which is yearly used in Saxon husbandry, therefore yields an increased crop of 240,000 cwt. of grain, and half a million cwt. in straw, or a corresponding amount of other crops.

For comparison of the strength of manure of the guano, with cow-dung, as the average of the experiments made in Saxony, it may be taken that one hundred weight of guano may be substituted for 65 to 70 cwt. of stable dung, or three large wagon loads; two to two and a half hundred weight of bone-powder gives the same result. But guano has the advantage before bone-powder, that it acts at once, and suits all kinds of soil; on the other

hand, bone-powder remains longer in its effect. The reflective agriculturist will hence easily understand, that it must be *very advantageous to add some guano to bone-powder*, in order that it may also act powerful the first year. The same is likewise good practice in the oil-cake.

For full manuring an average of four hundred weight for a Saxon acre, or two hundred weight for a Prussian morgen,* is the estimate, but we must be governed by the climate and soil; and in mountainous regions this amount is often exceeded, while in situations where the climate and soil are peculiarly favorable, it is lessened. As respects the *mode of using*, the following particulars may be mentioned:

1. The guano must be *prepared* before used on the field. This preparation is very simple, and consists in converting it into a uniformly powdered mass, and mixing it with earth. The former is effected on a threshing or barn floor, by sifting and threshing. First the fine portions are sifted out; then the lumps and pieces which remain are beaten fine, and again sifted, until all is reduced to powder. The last portion remaining is often so soft and sticky, that it spreads out flat in threshing, and cannot be passed through the sieve. This can again be beaten together with some brickdust, by which it easily acquires a pulverized condition, or it may be added to the compost heap, which should not be wanting on any good farm. The sifted guano is now mixed with two to three times as much earth, or a mixture of ashes and earth, and all is shovelled together till the most thorough and uniform mixture is effected. This earth must have the usual condition of moisture, without balling up, or forming clods. It is well to make the mixture at least four to six days before it is strewed on the ground. It is still better if this preparation is made beforehand, at some time chosen, when the work of the farm is not pressing, for it may easily be the case that at the seed-time the work may accumulate, and the mixing of guano with earth be done hastily, and not so well, which is attended by bad results. But if the mixture is in store these disadvantages are avoided. To put it on the field, is best done by means of a tray or trough, and scattering it with a ladle, as we do lime, or by sowing from the seed-cloth. It is well to effect the strewing two or three days before sowing the seed; then lightly harrow in the guano upon a light soil—rolling in will answer; and then harrow in the seed at the proper time. Moist weather has a very favorable influence on the efficacy of the guano, especially in the summer crop.

The addition of earth to the guano has manifold advantages. Pure, good guano is so rich in ammoniacal salts, that it easily operates like a steep on the tender roots of plants, especially in dry weather. By means of the earth it is so covered and divided, that this injurious effect is no more to be feared. When mixed with earth the gaseous substances from the guano are prevented, as the porous earth has the peculiarity of absorbing and retaining these substances. Finally, by the addition of earth a uniform distribution of the mass of manure of the field may be effected, and the dust prevented, which otherwise might occasion inflammations, and other injuries to the laborer.

With potatoes, vegetables, beets, &c., we can to every plant give a handful of the mixture of the earth with guano, in laying or planting them. One-third of an ounce of guano, which costs about one-fourth of a cent, is sufficient for one plant. As auxiliary manuring, the third and fourth part is efficacious; therefore a quantity of from $\frac{1}{48}$ to $\frac{1}{64}$ of a cent produces a very considerable increase of growth. Equally certain results

* 100 American acres are equal to 150 Prussian morgen.

are also obtained in the case of these crops, when the mixture of earth and guano is strewed as uniformly as possible in the furrows in which potatoes are laid; or when, in case guano is not immediately at command, it is applied at the surface of the field, after the potatoes have already come up, harrowed over, which is very advantageous, even when the potatoes have already reached the height of about four inches. One or the other mode is used for *garden plants*, for which, as well as for *grass* or *meadow land*, liquid guano is to be recommended. For this purpose take one part of guano, and at least 80 or 100 parts of water, since the guano with more strength acts corrosively on the plants. For manuring on the top, which, according to circumstances, is to be done in the autumn or in the early spring, guano mixed with earth may likewise be most appropriately used.

TESTING GUANO.

The above analyses of guano show that one kind may be *perfectly genuine*, but at the same time *really very bad;* how great must then be the danger of deception, if there be *purposed counterfeits* introduced which make a good kind bad, and a bad yet worse! In these circumstances it cannot be urgently enough recommended to farmers, that *he who would not run any risk of throwing away his money, let him not buy guano of any but a well-known authority, or after a previous chemical analysis.* If a farmer is not afraid of a little time and trouble, he can make this examination with ease for himself. There are tests now of such simplicity that they scarcely require greater skill and attention than the burning or boiling of coffee, and yet are accurate enough to serve as certain guides in doubtful cases.

1. *Testing by drying and washing.*—If the guano is in a state of uniform powder, as is the case with most of the kinds which come from Peru and Chili, weigh out two ounces of it, and let it lie spread out on paper for two days in a moderately warm spot; in winter in a warm room, and in summer in a dry airy place, in order that it may be air-dried. What it loses in weight for the time must be accounted as excess of water. Many kinds of guano are so moist that in this slight drying they lose from 20 to 24 per cent. of their weight.

If the guano, as in the case of the Patagonian and African, is of dissimilar condition, we must try to break up the lumps, which often have another composition than the powdery parts, and to reduce it to a mixture as uniformly as possible, before the portion set apart for drying is weighed. Any stones, feathers, pieces of leather, which are present, must be distributed equally through the whole mass. As the stones are often so firmly stuck over with guano that they can only be freed from it by scraping, it is well to pour over a separate portion of that guano hot water, and let it soak for a night, and the stones and sand remain behind.

2. *Testing by burning.*—Pour half an ounce of the guano to be proved in a large spoon, and place it over red-hot coals, till nothing but white or grayish ashes remain, which is to be weighed when it is cooled. *The less ashes remain the better is the guano.* The best kinds of Peruvian guano give from 30 to 33 per cent. of ashes, while the poor kinds, which are now so much offered for sale, as, for instance, the Patagonian, African, Saldanha bay, and Chili guano, leave from 60 to 80 per cent. of ashes, and that which is purposely fraudulent still more. The ashes of the genuine guano, the bad as well as the good, are always *white* or *gray;* a yellow or reddish color indicates adulteration with clay, sand, earth, &c. *This test is very simple, and also very certain;* it is founded on the fact that the nitrogenous com-

binations of guano, which, as mentioned in the foregoing pages, constitute its principal value, are dissipated and burnt out by the heat. The difference of smell during burning is also characteristic: the vapor of the good sorts has a suffocating smell, like spirits of hartshorn, and peculiarly pungent, like old cheese; that of the bad kind, on the other hand, like singed horn-cuttings or hair.

The burning may be done on a hearth, or in any stove. Thrust a brick far into the fire, and lay the spoon on it, so that the handle may rest on the stone, and the hollow part with the guano reach clear into the fire. On the outer part of the handle stick a cork, in order not to burn the hands while holding it.

3. *Testing with lime.*—Pour of the kind of guano to be proved, a coffee-spoonful into a wineglass, and add to it a spoonful of slaked lime; then pour in some spoonfuls of water, and stir it all briskly together. The lime extricates the ammoniacal salts contained in the guano, exactly as from decomposed dung, and stale liquid of dung: the ammonia is set free and escapes. *The more excellent the guano is, the stronger will be the suffocating ammoniacal smell which rises from the liquid guano.* This test has not the accuracy of the former one, but still it is very convenient in many cases to form a very approximative and general judgment respecting different kinds of guano. In present circumstances, it appears to be the more useful, as the middle sorts are now very rarely to be met with, and therefore in most cases we find in commerce only that which is of excellent quality or very poor, in the examination of which the lime test above given may be applied, as the difference of strength of the smell is indeed so remarkable that it cannot wholly escape the most inexperienced nostrils.

In order to try this test at any time, it is proper to keep ready a quantity of slaked lime. But that it may not lose its strength, it must be carefully excluded from the air; keep it therefore in a dry bottle, which is well closed with a cork stopper.

4. *Testing by washing out.*—Put half an ounce of air-dried guano into a filter made of press or blotting-paper, which is to be placed either in a tin funnel, or some other contrivance, to hold it; pour on it hot, or better, boiling water, as long as it runs through it of a yellow color. Lay the paper with the wet guano, when no more fluid drops from it, in a warm place, and weigh the part that remains after it has been thoroughly dried; and thus we may learn by the loss in the half ounce, the weight of those substances which have been dissolved by the water. The rule therefore is, *the more that is dissolved from any kind of guano in water, the more ammoniacal salts it contains, and better it is.* As in the test by burning, those kinds of guano are to be preferred, which leave behind them the least quantity of residuum after washing out. In the best sorts, and so in the Peruvian, the insoluble residuum of half an ounce is the proportion of about 50 to 55 per cent.; in the inferior kinds, on the contrary, 80 to 90 per cent.

But there may be exceptions to this rule when a guano contains much soluble mineral salts. We meet with kinds of guano in commerce which consist of one-half to one-third of sea salt and Glauber's salts, and kinds also which in being washed out by water would leave behind only one-eighth to two-eighths of an ounce of insoluble substances, without their, however, being good articles. In such cases we may protect ourselves against false conclusions, in the fullest manner, if resort be had to the test mentioned under 2, for then we should find that a guano of the kind just alluded to gives three-eighths of an ounce and more of ashes, and therefore must be reckoned as a poor sort.

5. *Testing by vinegar.*—Pour on the guano to be examined strong vinegar, or better, some muriatic acid; and if it effervesces strongly, we can conclude therefrom there is a designed adulteration of the guano with *lime*, which may also be ascertained by the second test, as the lime in burning remains behind, and increases the quantity of ashes.

The good Peruvian guano reaches Europe only by means of a trading-house (Gibbs, Bright & Co., London), which has concluded a contract with the Peruvian government, by which they have the exclusive trade in this guano.

PHYTANETIC RECORDS.*

We intend to furnish monthly records of the seasons founded upon the times of seeding, setting, blooming, and fruiting of such plants as have their regular seasons, the times for budding and grafting of various plants, and such other observations as may serve the purposes of farmers and gardeners in reference to seasons. It is well known that most of the published directions for *phytanetic* operations are made for special latitudes, and most of the seed packages, coming as they do from the more northerly States, contain directions for those States alone. For the States south of Virginia, or even Pennsylvania, we have but little that is reliable on this subject for a guide for farmers and gardeners.

For the present number we have but one locality represented, and that only in a partial manner, but which will serve as a good record of the mildness of the past autumn and present winter.

County of Washington, D. C., near Washington City, 150 *feet above the level of the Potomac. By Prof.* Page, *Ed.*

Nov. 8, 1852.—The first hard frost of the season on the night of the 7th November, 1852. Up to that time tender plants, such as egg-plants and tomatoes, not injured in exposed situations, and dahlias in full bloom, but somewhat exhausted from the great length of the season. All of them frost-bitten this night, and growth checked. In 1851, these tender plants were cut off in October. On 25th Dec. 1852, Christmas morning, a bouquet was gathered from the open grounds, as follows: chrysanthemums, drummond-flox, dwarf-flox, rocket-flox, heartsease, verbenas, fresh rose-buds, coral honeysuckles, petunias, green foliage of southern-wood, and flowers of creeping-myrtle.

Jan. 19, 1853.—On the night of Jan. 16, 1853, the thermometer fell to 18° Fahr. Up to this time the foliage upon most of the rose-bushes was fresh, and the plants were in many places in a growing condition. The foliage of the petunias also was in many spots entirely fresh. This night and the following, when the thermometer fell to 17° Fahr., entirely cut off the foliage of these and all the deciduous plants.

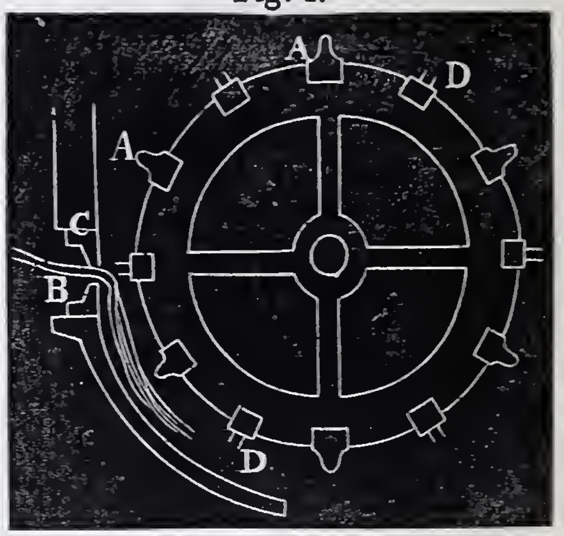
* Phytanetic is from a Greek word, which signifies time of planting.

REPORT OF PATENTS GRANTED FROM THE FIRST OF JANUARY.

Illustrated: with the Claims officially reported annexed.

No. 9512. James P. Arnold, of Louisville, Ky.—*Machine for Hackling Hemp.* Patented Jan. 4th, 1853.

Fig. 1.



This machine consists of a cylinder, upon which alternately a number of beaters A and hackling teeth D are fixed, as seen in sections, Fig. 1. The hemp is introduced between the rests B and C, against which the beaters and teeth work.

"I do not confine myself to any particular form or arrangement of the parts, so long as the machine is so constructed that it will operate substantially in the manner herein set forth. The form I have described and represented is the one I have essayed with success, and therefore deem it sufficient to show how my invention may be practically carried into effect. What I claim as my invention, and desire to secure by letters-patent, is the method of hackling hemp, by subjecting it to the action of a series of mixed beaters and combs, the teeth of the latter being of varying length, some of them not projecting so far, and others beyond the beaters, and the whole operating substantially in the manner herein set forth.

"I also claim a rest B C, having a narrow slot open at one end, in combination with a concave E, projecting beyond the end of the cylinder, at the open end of the rest, substantially in the manner herein set forth."

No. 9513. J. P. Bruen & J. J. Wilson, Hastings, N. Y.—*Improvement in Sawing Stone.* Patented Jan. 4th, 1853.

The nature of this invention consists in lifting the saw-frame sufficiently near the middle of its range of motion, in order to effect during the operation of sawing the proper supply with sand and water.

The inventors state that they have discovered that a much better effect is produced if the sand be introduced under the saw, at the middle of the stroke, than when introduced at the end, for the reason that the grains of sand are carried in one direction half the length of the stroke, and then back again in the opposite direction, presenting on the return motion opposite angles to act on the stone, whilst on the old plan the grains of sand act the whole length of the stroke in the same direction, and are then discharged, and in their improvement the fresh grains of sand with their sharp angles are made to act on the stone, when the saw is at its maximum velocity, whilst on the old plan, this takes place when the saw has its minimum motion.

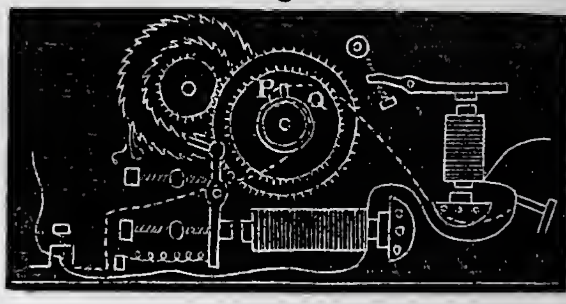
The frame is also provided with india-rubber cushions or their equivalents, between the ways and inclined projections, in order to absorb or reduce the concussions, which would otherwise take place when the wheels strike the said inclined projections.

"What we claim as our invention, and desire to secure by letters-patent, in the sawing of marble and other stone, is lifting the saws at or sufficiently near the middle of the stroke to effect the herein-specified purpose substantially in the manner specified.

"We also claim interposing india-rubber, or its equivalent, between the ways and the inclined projections which lift the saw-frame, substantially in the manner and for the purpose specified."

No. 9514. JAMES J. CLARK—*Improvement in Self-winding Telegraphic Registers.* Patented Jan. 4th, 1853.

Fig. 2.

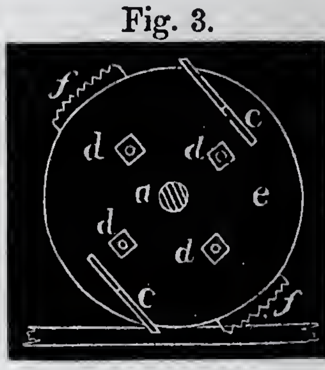


This improvement consists in an arrangement, by which, when the spring is wound up to a certain point, the current through the winding magnet is cut off by establishing a cross connection by the points P and Q, shown in Fig. 2, coming into contact, until the instrument has run down a little, when the points P and Q separate, and the current through the winding magnet is re-established, and the winding operation renewed.

"I do not desire to claim the application of the click and ratchet-wheel, operated by an electro-magnet, vibrating a lever, to cause rotation and obtain power; but what I do desire to claim, and secure by letters-patent, is regulating the current through the coil of the electro-magnet, of the self-winding apparatus, by means of the relative motion of the spring shaft and spring box, so that when the spring has been wound up to a certain point, that current shall be cut off, and the self-winding apparatus cease to act."

No. 9515. JOHN D. DALE, of Philadelphia—*Machinery for Planing Mouldings.* Patented Jan. 4th, 1853.

Fig. 3.

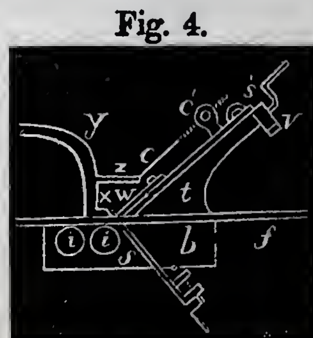


The object of the invention is to plane a plank into a series of mouldings, and separate them from each other at one operation; for that purpose the inventor arranges a series of moulding-cutters or plane-irons, side by side, fastened between disks *e d*, secured by screws, as seen in Fig. 3, representing a vertical section of the machine; the disks *d* with the planes *c c* are placed upon an axis *a*, with circular saws *f f*, or equivalents, for separating the mouldings at one and the same operation: the disks are held together by screw-bolts and nuts *d d d d*.

"What I claim as my invention, and desire to secure by letters-patent, is arranging a series of sets of moulding-cutters, or plane-irons, side by side, along the length of a rotating stock, substantially as specified, when this is combined with rotating saws, or their equivalents, interposed and projecting beyond the periphery of the cutter for separating the several mouldings, and separating them, are performed at one and the same operation, and accuracy of work secured, as set forth."

No. 9516. JOHN D. DALE, of Philadelphia—*Machine for Planing Mouldings.* Patented Jan. 4th, 1853.

Fig. 4.



This improvement consists in a planing-iron, which can be moved so as to produce the moulding by successive operations. In Fig. 4, *b* represents the bed-plate upon which the lumber *f* is placed to be planed; the plane-iron operates on the under surface of the board; the hinged plane-stock *v* is secured to the plane-iron *w*; *x* are pressure blocks; *z* a spring to receive the end of the set-screw

c', tapped in a bracket c' jointed to the side of a sliding-plate t, that holds the plane-stock; $i\ i$ are rollers.

"I do not wish to limit myself to the number of knives or rollers to be used; nor to the manner of operating the rollers, as these may be varied at pleasure. And I wish it to be understood that I do not wish to limit myself to the use of all my improvements in one machine, although the best results will be produced by the employment of all of them.

"What I claim as my invention, and desire to secure by letters-patent, is attaching the planing-iron to a plane-stock, which is hinged to an adjustable sliding-plate, substantially as specified, by means of which combination the plane-iron can be readily thrown up to be sharpened, without the necessity of taking it out of the machine, as set forth.

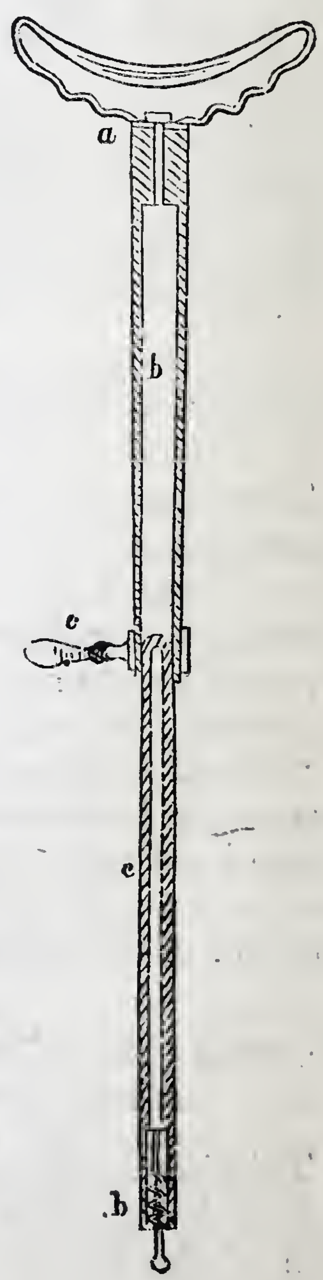
"I also claim the adjustable sliding-plane, substantially such as described, when combined with the separate movable mouth-piece, by the means substantially such as herein described, so that in setting the plane-iron, a differential motion is given to the mouth-piece, in order to vary, to any desired thickness, the shaving, that when the plane is set to cut a thick or thin shaving, the mouth-piece shall receive a corresponding set, as described."

No. 9517. Geo. & Geo. W. Feaga, of Frederick, Maryland—*Improvement in Grain Washers.* Patented Jan. 4th, 1853.

The nature of this invention consists first, in washing the grain in water, by which means the smut is loosened, garlic and other light impurities will rise and pass off with the water; the grain is brought by means of elevators or otherwise, into chambers heated by steam or hot air, where it is thoroughly dried, and thence carried to the stones for grinding.

"Having thus fully set forth the nature of our invention, and the means of putting it into practical use, what we claim as new, and desire to secure by letters-patent, is the method herein described, of separating grain from smut, garlic, and other impurities, by first washing it in a trough or reservoir of water, where the separation takes place, and then conveying the washed grain to a drying apparatus, where it is thoroughly dried—the whole operation being performed substantially in the manner herein set forth and described."

Fig. 5.



No. 9518. John S. Gallaher, Jr., of Washington, D. C.—*Improvement in Crutches.* Patented Jan. 4th, 1853.

This improvement consists in crutches made of an elliptical spring, corrugated or otherwise, and an air-cushion. The crutch is made to revolve upon the staff, as shown at a, in Fig. 5; the upper part of the staff b is hollow or tubular, and wide enough to admit the lower part e; the hand-rest c is movable, revolving, and adjustable; and the ferule d is provided with a spring and a bulb end.

"Having described the construction and operation of my improved crutch, what I claim, and desire to secure by letters-patent is,

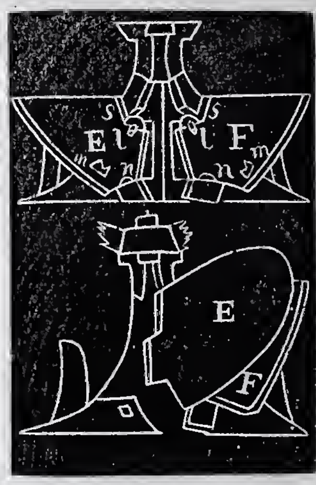
First, the *revolving, plain, or corrugated* spring top in *combination* with an *air*-cushion, substantially as above described.

"Second, I claim, in *combination* with the revolving spring top, the *sliding* joint applied to the *staff* of a crutch, in the manner and for the purposes described.

"Third, I claim, in *combination* with the *sliding* staff, the *revolving* handle, *extension* ferule, and *elastic* bulb, as above described and set forth in the accompanying drawing."

No. 9519. SAMUEL HALL, of Pittsburg—*Improvement in Hillside Plough.* Patented Jan. 4th, 1853.

Figs. 6 and 7.



The improvement of this plough consists in the greater strength and durability which the mould-board obtains, by resting on the landside, first by the hinges E E′ and *n n′*, seen in Fig. 6, and the edges of the mould-board at *s s*, further against the projections *m m*, placed as far as practicable from the mould-board, to prevent too much strain upon the hinges, which would occur otherwise constructed, having the whole pressure of the furrow-slice upon that point.

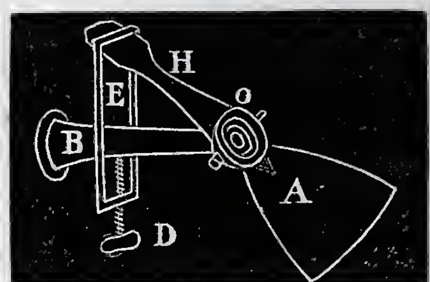
Fig. 6 is a side elevation with the mould-board spread to show the mode of hinging.

Fig. 7 is a side elevation of the plough, with the mould-board set properly.

"What we claim, as the invention of Samuel Hall, and desire to secure by letters-patent, is the manner of arranging the mould-boards upon the landside, to wit: placing their hinges at such a distance from each other on each side of the centre of the landside, that each mould-board may be supported by the edges *s s* and projection *m*, as far as practicable, from the hinges, and rest upon the grooves near the middle of the landside, substantially for the purposes herein set forth."

No. 9520. RICHARD HOLLINGS, of Boston—*Regulating the Spread of Water when Discharged from Hose.* Patented Jan. 4th, 1853.

Fig. 8.



The water is spread by means of a flat, fan-shaped piece A, see Fig. 8, which is attached at the mouth of the hose pipe B by means of pins, which pass through the collar O; the spread A has a handle H, which rests against the upper part of the frame E, and is regulated by a thumbscrew D.

"What I claim as my invention, and desire to secure by letters-patent, is hanging the spread A to the hose pipe by means of pins passing through the collar O (which allow it to vibrate), in combination with adjusting apparatus for varying the position of the spread in the manner specified."

No. 9521. B. F. JENKINS & L. L. KNIGHT, of Barre, Worcester County, Mass.—*Machine for Turning irregular forms.* Patented Jan. 4th, 1853.

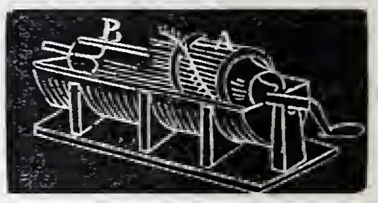
This invention belongs to that description of lathe in which the work and cutters both revolve, and the irregularity of form is produced by the vibration of the axis of the work, and of the whole or part of the cutters. The improvements consist in controlling the vibration of the said axes.

"We do not claim the vibrating cutting cylinder and vibrating work carriage;

"But what we claim, and desire to secure by letters-patent, is giving the necessary relative vibrations to the cutter, cylinder, and work carriage, by crank pins or eccentrices upon the axis of a pair of toothed wheels, of which one is toothed all round its periphery, and the other upon any suitable portion of its periphery, the latter wheel having a constant rotary motion applied, which gives an intermittent rotary motion to the former wheel, whereby the said cutter, cylinder, and work carriage receive, the one a constant vibratory motion, and the other, an intermittent vibratory motion, substantially as described."

No. 9522. Meritt Peckham & Lucius O. Palmer, of Utica, N. Y.—*Improvements in Ore Washers.* Patented Jan. 4th, 1853.

Fig. 9.



This ore washer consists of an outer hollow cylinder A, composed of several wings or segments, between which rods are inserted to allow the finer particles to pass through, and a solid cylinder B in the centre, the ends of which are at one end indented.

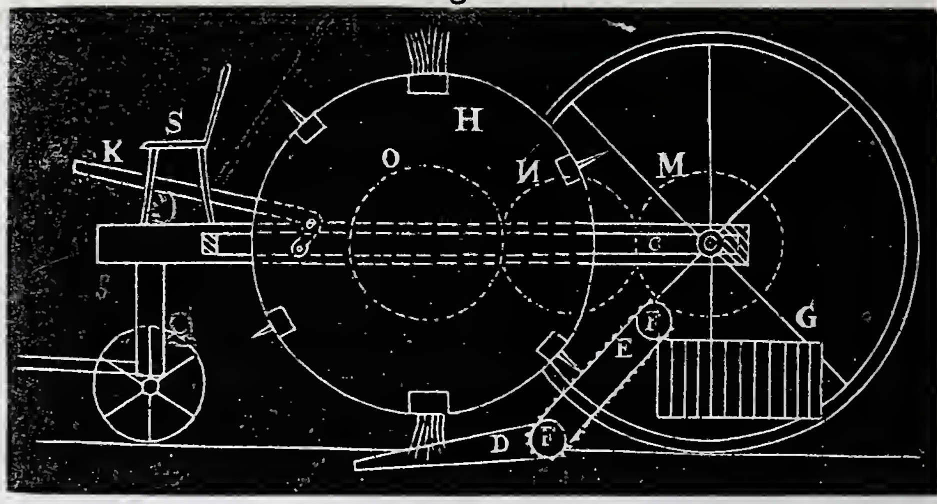
To operate this machine, the trough is filled with water, and a small stream of it kept constantly running in at the upper end of the trough. The cylinder is made to revolve in the water in the direction of the arrow and the earth thrown into the hopper, falling to the lowest part of the same at M, Fig. 9, which is inclined at an angle of about $22\frac{1}{2}$ degrees towards the cylinder; and as all parts of it are the same, the earth and whatever may be mingled with it, slides through the apertures in the head into the cylinder, when more is thrown into the hopper. The cylinder, being divided by the wings into different sections, the earth within it is made to revolve at the same time with the cylinder, and as this end is the highest, at each successive revolution of the cylinder the mass must come nearer the lower end of the machine.

When the stones (having by their movements in the water become divested of all loose particles), have reached the lower end of the cylinder, they fall from the wings upon the inclined concave surfaces and are thrown out, while the small bodies which have passed between the rods of the cylinder, and cannot be removed by the water, settle to the bottom of the trough, where they are constantly stirred by the teeth *f* on the outside of the cylinder A. The first tooth in the bar enters the contents of the trough first, and the others follow in succession, each nearer the upper end of the trough than the preceding one, and in this manner they effectually counteract the tendency of the contents towards the lower end of the trough. When the operator desires to draw off the contents of the trough, he draws upwards the slide and reverses the motion of the cylinder, when the teeth, by entering the trough first at the upper end, together with the inclination of the trough and the current of water, will effectually empty the trough of its contents. The machine can be elevated or depressed so as to give the contents a greater or less amount of friction, as the nature of the earth in which gold is found may require.

"We claim as our invention, and desire to secure by letters-patent, the interior cylinder with indented ends, and wings attached, as described, to operate as a discharging apparatus attached to the interior of an inclined revolving screen, in the manner and for the purpose specified."

No. 9523. Francis C. Schaeffer, Brooklyn—*Implement for Digging Potatoes.* Patented Jan. 4th, 1853.

Fig. 10.



The potatoes are scooped from the hills by means of the scoop D (see Fig. 10); the cylinder H is provided with teeth and brushes, to throw the potatoes upon the endless apron E, running over rollers FF; this endless apron carries the potatoes into the receptacle G; the dirt and mould passes through the bottom of the scoop, and through the endless apron, made of iron rods. The driver, who may be seated at S, can elevate or depress the scoop by means of the lever K, whereby the frame is operated upon, in which the scoop and cylinder rest. The driving geering is attached to the hind wheel, and operates by means of toothed wheels M N O, upon the cylinder H.

"I am aware that machines have been previously used for digging potatoes; but in those machines the potatoes are dug or scraped from the hills by means of a concave or scoop, formed of a single piece, the brush cylinder carrying the potatoes up the concave and into the receptacle. I therefore do not claim the above arrangement; but what I do claim, and desire to secure by letters-patent, is the arrangement and combination of the scoop D and endless apron E, by which the potatoes are dug or scooped from the hills, and the dirt thoroughly separated therefrom, as they pass up the endless apron into the receptacle."

No. 9524. William Watson, of Chicago, Illinois—*For Improvement in Tongueing and Grooving.* Patented Jan. 4th, 1853.

The inventor states that the operation of tongueing and grooving, by means of his improvement, may be effected with very little labor, by reason of the gradual nature of the cut, which is in proportion, as the length of the knives and number of gouges are increased, will be rendered still easier, while the tongue formed is clear and perfect. The board is forced along between the tongueing and grooving stocks by any well-known feeding apparatus. The stocks are stationary, and each knife set therein projects a little more than the preceding one, in order to make the cut somewhat deeper.

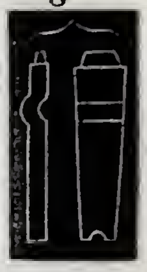
"Having thus described my improvements in tongueing and grooving machines, what I claim therein as new, and desire to secure by letters-patent, is the method substantially as herein described, of tongueing and grooving boards, by means of knives, arranged in the plane of the sides of the tongues or grooves, with their cutting edges inclined towards their rear extremities, so as to cut gradually deeper and deeper, as the board passes them, when in combination with cutting instruments, arranged between these side knives, to reduce or remove the surplus wood, which is severed by them, substantially as herein specified."

No. 9525. Jeptha Avery Wilkinson, Fire-Place, N. Y.—*Improvements in Printing.* Patented Jan. 4th, 1853.

This improvement consists in the combination of the proper machinery

for folding and cutting the sheets, in cylinders to secure the types upon; the shaft of each type being formed of a taper or radial line, corresponding with a line drawn from the centre of the cylinder to its periphery, each type shaft having a notch on one side and a projection on the other (see Fig. 11), by which the type not only lock into each other, but also fit into beads or grooves on the inside of the cylinder.

Fig. 11.



"I am not aware that type have ever been formed with two parallel sides, and two sides tapering on the radii of a circle, with a groove on one side and a projection on the other, so that on setting the parallel sides together and the tapering sides together, and placing the projecting beads into the corresponding grooves, a cylinder is formed of firmly secured type, with their faces equidistant from the centre, by which means the printing is effected the same as though the whole was solid in a perfect cylindrical form; this constitutes the essence of my invention, and the other parts claimed are the means to use, to form, regulate, and work this main invention, and for parts growing out of or connected with the same.

"1st. The application of notches or grooves, and beads or projections, on the shafts of type tapered to the radii of a circle for the purpose of locking said type together, and securing it in place on a cylinder, substantially as described and shown.

"2d. The mode described and shown of forming column lines, rules, rings, and blocking, so that they are adapted to the cylinder and to the type, with notches and projections to lock into the type and cylinder, substantially as described and shown.

"3d. The mode described and shown, of constructing the type cylinder with heads; the one head having a bead or projection, the other with a notch or groove around in its face, near the edge, for the purpose of receiving and securing the type or other parts composed, on the surface of said cylinder; such heads being fitted with means to compress and hold the type and parts in cylindrical form, for the purpose of printing, by a rotary movement, substantially as described and shown.

"4th. The mode of constructing the compositor's stick in the form of a part of a cylinder, with flanches, having beads or grooves, so as to hold the type in segments of a circle, while composing or setting up, preparatory to the placing of the same in the galley or proof cylinder, substantially as described and shown.

"5th. The mode of constructing and applying the galley or proof cylinder so that it shall receive and hold the type in circular form from the composing-stick, and retain the type and the needful parts in place for correction and proof, and for transferring the same to the type cylinder, the parts being constructed and operating substantially as described and shown.

"6th. The mode of forming and constructing the type-holder or grab, to inclose, take hold of, and securely lift a mass of type from the galley or proof cylinder, and transfer the mass either to the type cylinder, or to a stack, for further use, or to reverse or vary either of these operations, as may be needed, the instrument being constructed and operating in the manner and with the effects described and shown.

"7th. The application and arrangement of the pulleys, bands, and guide-plates, so placed and moving, as to carry the sheet of paper from the press, in lines diverging vertically and conveying horizontally, under, between, and over the guide-plates, thereby presenting the paper in a folded form to the compressing rollers, substantially in the manner and with the effects described and shown.

"8th. The application of the press-rollers, to compress the folded paper, and lead that out of the folding apparatus, and the combination of the standing-roller, revolving-shear, standing-shear, valve, and cam, to effect the cutting of the folded paper, as it issues from the rollers, and guide the fresh cut edge clear of the standing-shear, the whole of the parts being constructed, arranged, combined, and operating substantially as described and shown."

No. 9526. Rudolph Kreter, of New York—*Machine for Covering Hammers for Pianos.* Patented Jan. 4th, 1853.

Figs. 12 and 13.

This invention has for its object to make coverings of hammers for pianos in a connected set. The inventor uses three coverings for the hammers. The several coverings are placed in a clamp, and placed into the machine, when the sliding-frame descends, and carrying the covering with it, held between the clamps, whereby the layers of the hammer covers are properly turned up, as seen in Figs. 12 and 13.

The degree of pressure is regulated by weights or springs, and it produces a good and regular fit on the end of the hammers, and gives it the proper shape. To increase the pressure at the side of the hammers, the vise is provided with screws and bolts, which can be tightened at pleasure. When the hammers are properly fixed, the bar K is lowered to remove the pressure against the heads of the hammers.

"What I claim as of my invention, and desire to secure by letters-patent of the U. States, is—1st. The application of the felt or other covering material to the whole set of hammer-heads at one operation, in the manner described.

"2d. I claim the clamp A, bar *k*, levers, pulleys, and block B, with the sliding-frame *p* in combination, substantially as described; but without limiting myself to the precise shapes and proportions or positions of the said parts, provided the arrangement embrace the means of holding the set of hammer-heads, and of bringing them to bear upon a table containing the strips of felt described; and also the holding and moving the whole together, either horizontally or vertically, to and from the jaws of the vise, as set forth.

"3d. I claim the vise in combination with and inclosing the bar *k* and block B, as described.

"4th. I claim the lip-pieces, in combination with said vise, for the purpose described.

"5th. I claim the levers and springs, in combination with the vise, for producing the pressure upon the sides of the felt, during the passage of the hammer-heads between the jaws of the vise, as described.

"6th. I claim the method of increasing or diminishing the pressure ot the levers upon the vise, by means of the movable bridge *x*, in combination with the press *x'* and *y*, as described."

No. 9527. Walter Hunt—*Improvement in Bottle and Decanter Stopper Swivel Caps.* Patented Jan. 4th, 1853.

Fig. 14.

The annexed drawing, represented in Fig. 14, and the following claim, explain this improvement in bottle and decanter stoppers fully.

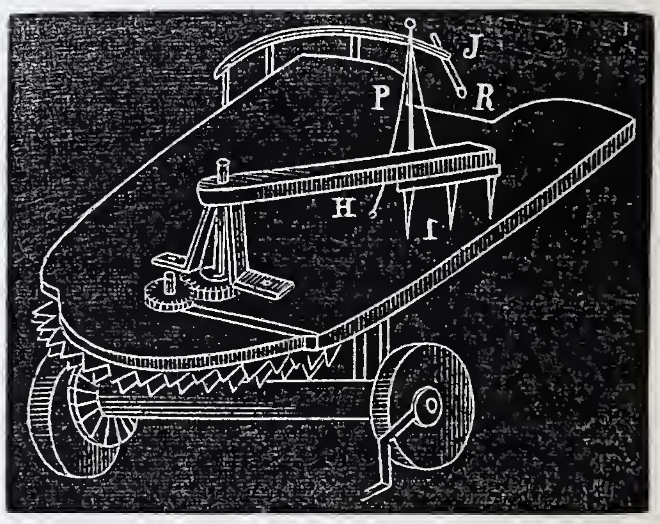
"I am aware that there have been other plans of self-acting

stoppers recently introduced. I allude to the bivalves, hinged at the top, which, in short, is nothing more than the valve of the treacle cup duplicated, and its application to rum instead of molasses. There are also other plans of recent date, which have sprung up since mine were commenced, constructed upon the principle of puppet valves—all of which have the same objection of producing an uncertain scattering or over-discharge, and are constructed upon principles widely different from my above-described plan, and to which I make no claim in this application.

"*But what I do claim*, and desire to secure by letters-patent, in my above-described invention, is the combination of the circular cap F′ and the central shaft E, upon which said cap is suspended, so as to allow of its having three principal motions, viz., the swivel, pendulous, and sliding motions, by means of which, without regard to which side of the stopper is upward (when it is placed horizontally, or nearly so), the under portion of the cap swings off from the *flange* C, thereby producing a downward opening between the two, for the requisite discharge of the liquids contained."

No. 9528. Thomas Baylis & Daniel Williams, Tecumseh, Mich.—*Improvement in Rakes to Harvesters.* Patented Jan. 11th, 1853.

Fig. 15.



The inventor places upon a platform of a grain-cutting machine, as shown in illustration, Fig. 15, a revolving rake-arm H, which carries a rake I and describes a circle upon the platform, gathering the cut wheat into a sheaf, which is discharged at R; the movable joint J is a break attached to the side railing, designed to change the direction of the rake-head at R, and to aid in discharging the sheaf.

To the rake-arm is fixed a post P with a small pulley, over which a small cord passes with a weight at K, the other end being attached at the head of the rake.

"What we claim as our invention and improvement, and desire to secure by letters-patent, is

"The construction and method of operating the rake, together with the use of the jointed brake, in facilitating the discharge of the sheaf at the rear of the machine, as set forth."

No. 9529. Nathan Chapin, of New York—*Duplicate Turning.* Patented Jan. 11th, 1853.

The inventor, in setting forth the advantages of his improvement in turning of profile work, says: "They are, great accuracy, as all the pieces must necessarily be alike, and obviates the necessity of removing them until finished, not only on the outside, but also on the inside edges or profile, while the sliding clamps admit securing the pieces, irrespectively of accurate length, and permit the forming of tenons and plinths on the ends, which is important in forming baluster stuff; the open slots give great facility of entering endwise the material.

"What I claim as my invention, and desire to secure by letters-patent, is constructing the clamping heads with a projection on the interior face, in combination with the orifices cut through said clamps and projection, for

the purpose of introducing key slats, in order to retain the pieces firmly in position during the operation of turning the interior and exterior surfaces.

"Second. I claim giving to the sliding and vibrating interior cutter suspended on the stationary mandrel, motion corresponding to the pattern to be turned, by a rod passing through the stationary mandrel, in the manner and for the purpose herein described."

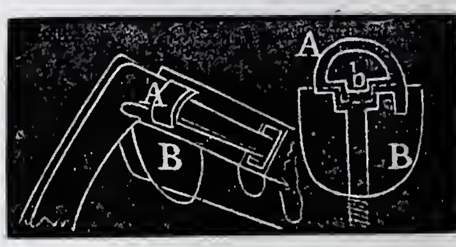
No. 9530. Moses G. Farmers, of Salem, Mass.—*Improvement in Porous Cells for Galvanic Batteries.* Patented Jan. 10th, 1853.

In order to prevent evaporation of the acid in the porous cell, the inventor makes the cover of earthenware of the same material as the cell, and while it is in the plastic state he inserts strips of platina, and glazes and bakes it afterwards. Instead of making the whole vessel porous, he glazes the greater part of it, inside and out, leaving only a small portion unglazed, for the electricity to pass through the porous portion of the unglazed earthenware.

"I claim as my invention, the improved cell, as made substantially as described, viz., with a part only of it porous, or so as to permit the electricity to pass from the nitric acid or liquid within it through such part and into the liquid surrounding the cell, the remainder of the cell being made by glazing or other means, impervious to the passage of electricity and acid or liquid through it, as specified."

No. 9531. Pinkney Frost, of Springfield, Vermont—*Fastening Scythes to Snath.* Patented Jan. 11th, 1853.

Fig. 16.

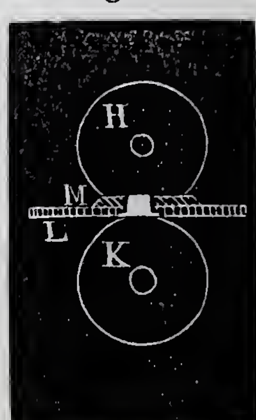


This invention consists in a loop A and the set-ring B, constructed as shown in Fig. 16; the set-ring has a groove, as shown at *b* in the dotted lines, which corresponds with the groove in the loop. The loop is fastened by means of a screw.

"What I claim as my invention, and desire to secure by letters-patent, is the peculiar construction of the loop and the set-ring, with the grooves *b*, in the manner and for the purpose set forth."

No. 9532. Ammi M. George, of Nashua, N. H.—*Improved Method of Hanging Circular Saws.* Patented Jan. 11th, 1853.

Fig. 17.



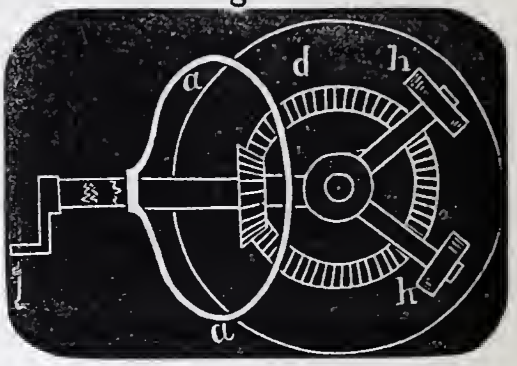
The nature of this invention consists in supporting and guiding a circular saw L, shown in Fig. 17, which is driven by the friction-wheels H and K applied near the periphery of the saw, by means of a guard-plate M, in which the arbor of the saw-plate works, which enables the inventor to saw boards or veneers by means of circular saws at a width almost equal to the diameter of the saw. The guard-plate has an opening at each end, through which the friction-wheels H H′ K K′ pass. These friction-wheels are set in motion by pulleys and bands.

"Having thus fully described my invention, what I claim therein as new, and desire to secure by letters-patent, is, in combination with a circular saw driven by friction near its periphery, the guard-plate, with its arbor, around which the saw runs, and by which it is held into the wood, and on which the board or veneer being sawed may rest, and relieve

the saw from all friction therefrom, and by which means I am enabled to cut boards or veneers of nearly equal width with the diameter of the saw, substantially as described."

No. 9533. John L. Gilliland, Brooklyn, N. Y.—*Improvement in Punty Iron for Fire-Polishing Glass.* Patented Jan. 11th, 1853.

Fig. 18.

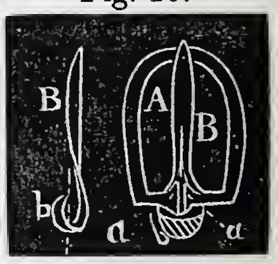


Articles made of glass, which require a high polish, that cannot be attached by means of a piece of glass to the ordinary punty iron, without destroying their surface, as, for instance, lenses, object and image glasses, the inventor uses a horizontal rotating table *d*, on the end of a hollow handle *a*, through which a shaft passes, which, by turning the crank *g* and the geering under the table, as shown in the illustration, sets the table revolving. The articles of glass placed upon said table can be rotated in the furnace or glory-hole, so as to receive the heat equally on all parts.

"What I claim as my invention, and desire to secure by letters-patent, is the method, substantially as described, of fire-polishing glass, by means of a rotating table, provided with a hollow handle, or its equivalent, and geer, by which said table can be rotated as described."

No. 9534. Peter P. R. Hayden, of New York—*Improvement in Buckles.* Patented Jan. 11th, 1853.

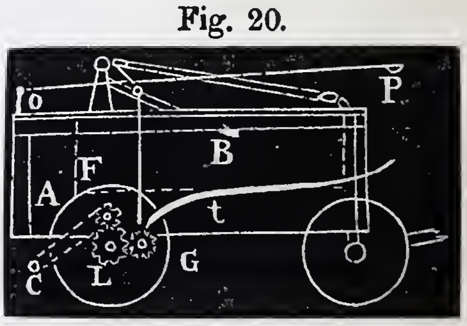
Fig. 19.



The annexed illustration, shown in Fig. 19, explains the improvement fully. The inventor claims, "constructing the buckle in the manner substantially as herein shown and described, viz.: by uniting or connecting the two ends of the body A of the buckle, by means of a boss *a*, formed at each of the two ends of the body; said bosses being in contact with each other, and forming a bulb around which one end *b* of the tongue B, is clasped. The end *b* of the tongue which surrounds the bulb, having a recess or groove in its inner surface, which conforms to the convexity of the bulb, and keeps or binds the bosses firmly together, and also keeps the tongue in its proper place."

No. 9535. Silas A. Hedges, of Lancaster, Ohio—*Improvement in Carts for Distributing Manure.* Patented Jan. 11th, 1853.

Fig. 20.



This invention consists in two cart bodies; one to hold the manure, which is suspended within the frame of the other large cart body; at the lower part of the rear end of the cart body A is a revolving endless belt C, which distributes the manure. This belt is moved by a cog-wheel geering into wheel L. The manure contained in the cart body B falls upon the endless belt C, when it is lifted by means of a rope, which works around an axle G. This axle is turned by means of a cog-wheel, which can be geered by means of the lever J into the driving geer connected to the hind wheel; the tail-board O is lifted by the lever P.

"Having thus fully described my invention, what I claim therein as new, and desire to secure by letters-patent, is constructing a manure cart with

two bodies; the front one of which is raised or tilted, for the discharge of manure into the rear one by the action of the hind axle, by means of the axle G and tackle I, when thrown into geer by the hand-lever J, arranged and operating in the manner and for the purpose set forth.

"I also particularly claim the combination of the endless apron, the tilting-bed, and raising the tail-board, simultaneously with throwing the endless slotted apron, in the manner and for the purposes fully set forth."

No. 9536. William Mann, of Philadelphia—*Improvement in the Manufacture of Copying Paper.* Patented Jan. 11th, 1853.

In order to make a copying paper, which absorbs the copying properly, and furnishes a perfect impression from the original, the inventor combines manilla hemp fibres and cotton in equal parts. The inventor says in his specification, "The peculiarities of both these substances are, when damped, that they absorb or receive a portion of the ink from every part of the writing and the contractive property of the manilla in drying, serving to give a sharp outline to the impression thus made by absorption, and preventing the ink from running, spreading, and blurring, whilst the flexible nature of the cotton neutralizes the manilla fibre in its action.

"What I claim as my invention, and desire to secure by letters-patent, is the copying paper herein described, composed of manilla fibre, or the equivalent thereof, tempered with cotton or its equivalents, substantially as herein set forth."

No. 9537. A. Aayres—*Improvement in Screwing Apparatus.* Patented Jan. 11th, 1853.

The nature of this invention consists in fitting and securing solid dies between the two side plates of a stock in such a manner that their turning and motion endwise, or in the direction of the axis of the screw, is prevented, but that a certain amount of movement, laterally or transversely to the axis, is allowed. The reason for allowing this movement is to enable the dies to accommodate themselves, as the pipe or other articles are turned to fit it to any bends or irregularities which may occur in it, and which, if the dies are fixed, cause it to jam, and render it more difficult to turn and prevent the screws being truly cut.

"What I claim as my invention, and desire to secure by letters-patent, is arranging solid dies between the side plates, or their equivalents, of a stock, in such a manner that they are free to play, to a limited distance, in a plane perpendicular to the axis of the bolt or pipe to be screwed, while they are, at the same time, incapable of revolution in the same plane, substantially in the manner and for the purposes described."

No. 9538. Richard Montgomery, of New York—*Improved Method of Connecting Sheets of Sheet-Flue and Water-Space Steam-Boilers.* Patented Jan. 11th, 1853.

Fig. 21.

The inventor makes his boiler of corrugated iron with flat margins, and overlaps the edges of the water-spaces, whereby he dispenses with the usual flue-sheet, and claims to be enabled to build his boiler much cheaper in consequence of a reduction of material and labor in putting the joints together, or lessening the number of joints between the water-space and the flues. The illustration shown in Fig. 21

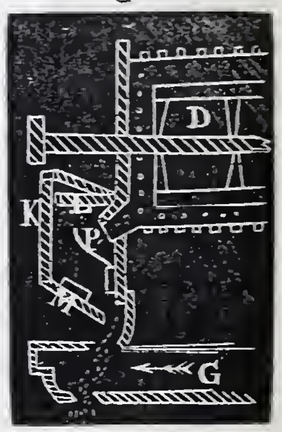
shows the arch of the fire-box and the mode of fastening the water-spaces B, and the formation of the flues C, by means of tongues cut out from the cross-sheet, to which alternately the water-spaces are secured.

"Having thus described my improvements in steam-boilers, what I claim as new, and desire to secure by letters-patent, is riveting together the overlapping flanges of the opposite sides of sheet-flues in steam-boilers, in the manner described, whereby the flues are firmly attached, each to each, and the usual flue-sheet is dispensed with; and also certain advantages in construction attained in other parts of the boiler, as described.

"I also claim the method of connecting a series of flues and water-spaces with the roof or arch of the fire-box, by means of tongues, which project from the latter, and are secured alternately to the faces of the water-spaces and to the tops of the flues."

No. 9539. DAN. PEASE, Jr., of Floyd, N. Y.—*Improvement in Smut Machines.*

Fig. 22.



The inventor uses a perforated metallic scouring cylinder A, in which the beaters D revolve, driven by a pulley; on the same shaft at the other end of the annexed illustration, Fig. 22, is a fan-blower, which drives the air through the channel G in the direction of the arrow, to blow the dust from the grain. The grain passes from the cylinder at O into the box K, when they are forced against the deflector P with great force, and are scattered upon the inclined plane M, which is provided with ribs *s s*, to divide the grain as evenly as possible, and expose it to the current of wind.

"What I claim as my invention, and desire to secure by letters-patent, is the employment of the adjustable deflector P, set at an angle to throw the grain in different directions, in combination with the receiver K L M, the top of said receiver being adjustable to any height desired, and the front-piece K of the same being set in such a position in relation to the deflector P, that it will, when the grain strikes the deflector, be thrown against the said plane surface K, which, from its peculiar position, will throw the grain in a partially spread state, up against the adjustable top L, which causes it to spread still more, and then to fall down on the ribbed bottom M, and pass off through the wind pipe.

"I also claim causing the grain to spread to a greater or less degree, by making the top of the receiver adjustable to different heights, in the manner and for the purposes herein described."

PUBLICATION OF PATENTS.

WE express the general, if not the universal sentiment of inventors, in our thanks to the Hon. Mr. Cartter, Chairman of the Committee on Patents, for his promptness, energy, and fidelity to the cause of inventors, in bringing forward and procuring the passage of the annexed bill in the House of Representatives on Monday, the 24th ult. The publication of the digest of patents has been long and most earnestly desired; and we were on this occasion specially gratified to see with what confidence and cheerfulness the House met Mr. Cartter's propositions, and we readily account for it in the

fact that Mr. Cartter has, from the commencement of his duties as Chairman, identified himself with the true interests of inventors, and the elevation of our patent institution. The following is a copy of the bill as it passed the House.—*Editors Amer. Pol. Jour.*

PATENT-OFFICE REPORTS.

Mr. Cartter.—I ask the unanimous consent of the House to report a bill which I sent to the Clerk's desk. The bill will explain itself, and I hope the House will give their attention.

The bill was then read, as follows:

An Act to regulate the report of the Patent Office, and providing for additional officers therein.

Sec. 1. *Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled*, That the Commissioner of the Patent Office shall cause to be prepared a general analytical and descriptive index or digest of all such discoveries, patented under act or acts of Congress, as he shall deem important to be made known and published, and of all such discoveries and inventions made in this country as tend to illustrate those so patented as aforesaid; to be accompanied with such proper drawings as are requisite for understanding the same; shall from time to time publish such portions thereof as are sufficiently prepared for that purpose, and distribute and sell the same as in his judgment will be best for the public interests; and shall report the whole, when completed, to Congress. And the net proceeds of the sales hereby authorized shall be accounted for by him and credited to the patent fund.

Sec. 2. *And be it further enacted*, That in lieu of the list of inventions and claims heretofore contained in the annual report of the Commissioner of Patents, he shall cause to be prepared and embrace in his annual report, short, intelligible descriptions of the several inventions and discoveries patented during the year, accompanied with such drawings as are necessary for understanding the same, and an analytical and alphabetical index of the same, according to the subjects.

Sec. 3. *And be it further enacted*, That one compiler, with an annual salary of twenty-five hundred dollars; one assistant compiler, with an annual salary of fifteen hundred dollars; and one engraver, with an annual salary of twelve hundred and fifty dollars; and one additional examiner and assistant examiner, to be paid like those now employed in the Patent Office, shall be appointed in the manner provided in the second section of the act approved July 4th, 1836, entitled "An act to promote the progress of the useful arts, and to repeal all acts and parts of acts heretofore made for that purpose."

Sec. 4. *And be it further enacted*, That the Commissioner of Patents is hereby authorized to draw upon the patent fund from time to time for such sums as shall be necessary to carry into effect the provisions of this act, and they are hereby appropriated for that purpose.

ERICSSON'S CALORIC ENGINE.

Since the publication of our first number, there has been an experiment for once more testing the capabilities of heated air as a motive-power, which, for its stupendous magnitude, deserves more than a passing notice. Although we regret to say that no reliable information has yet been published by the inventor, by which a correct judgment could be formed by the engineer and man of science of the exact practical utility of the device.

The public has been somewhat excited and astonished by the current reports in the papers of the day, which do not, however, so far as we have seen, throw any real light upon the subject. Air as a motive-power is an old acquaintance of ours, and numerous have been the bright expectations blasted by a failure to make it useful: like its compeers carbonic acid gas and alcohol, there seems to be an inherent defect preventing its successful introduction, which we regret our want of space to clearly show at this time.

This invention, as put forth by Capt. Ericsson in a pamphlet some twenty years ago, was clearly refuted by a writer in the London "Repertory of Patent Inventions," in January, 1834. A similar one, patented by Sterling in 1827, had long before proved worthless; and until it can be shown that this has some radically new feature, which does not appear from the patent, we fear it will share the same fate as its predecessors.

The great feature of this engine, we are informed in one of the daily papers, from which we quote, is the "regenerator," consisting of "a series of wire nettings placed side by side to the thickness of twelve inches, presenting a metallic surface of 15,000 square feet, in which are contained upward of 100,000,000 of meshes—minute cells, through which the air is forced, and in which it imbibes or parts with caloric to the amount of 450°." The same paper goes on to say, and we understand it to be reporting Capt. Ericsson's words: "The maximum temperature, which is requisite for doubling the volume of atmospheric air, is 480° F., of which 30° are afforded by the furnace, and the residue by the regenerator." "This action is instantaneous." Taking for granted the correctness of these numbers, which we by no means admit, we regret that among the questions asked Captain Ericsson, there were none that elicit the facts upon the following points, which would have thrown some light probably upon the subject: What is the velocity of the air through the regenerator for any given velocity of piston? Is its course straight or otherwise? What force is required to drive the air through the regenerator, or in other words what is the difference between the pressures on the two sides of the regenerator, when making nine or any fixed number of revolutions? Would it or not require four times as much power to force it through at double that velocity, and if not, what increase of power would be required? What is the greatest number of revolutions obtained with these engines, with the working-cylinder 168 inches and supply-cylinder 137 inches diameter? Is any auxiliary power required to supply air, other than the supply-cylinders?

We cannot close our brief remarks upon this subject without paying a tribute of respect to the gentlemen who have been induced to freely advance the money to carry forward a project having ostensibly for its object the saving of human life. The motive was philanthropic, and if its object fails it will not be their fault, for they could not be expected to have a knowledge of so difficult a subject; their motive was equally honorable whether their effort should be crowned with success or disappointed by a failure.

J. J. G., *Ed.*

NOTICE.

PHYTANETIC RECORDS.

The Editors of the American Polytechnic Journal are desirous of procuring the services of some skilful observer of plants to furnish monthly an account of the seasons for seeding, planting, and gathering the important vegetables, fruits, and flowers, of various localities; times of budding and grafting, of blooming and fruiting; and also the times at which the various annuals are cut off by autumnal frosts; and what cultivated plants survive the winter; and, in fine, any thing remarkable in the season connected with *cultivated* plants. As we propose to collect these records from all parts of the United States, that part of the Journal will be specially valuable and interesting to gardeners and farmers: in return for this service we will send monthly, free of postage, a number of the Journal. The Journal, it will be seen, has a considerable space devoted to agriculture in all its branches. It is desirable that the records should be full, but in condensed form; and in case they should prove satisfactory, the Editors will be ready to give an adequate remuneration.

MISCELLANEOUS.

TANNING LINEN, HEMP, AND COTTON GOODS.

Wimmer made a decoction of half a pound of good oak bark with 12 lbs. of water boiled down to 8 lbs. In this hot decoction he placed, for forty-eight hours the articles to be tanned, and dried them in the air. The articles were placed for eight months in a very damp cellar, where they remained perfect, without the least alteration; whilst untanned articles of the same description, and under the same circumstances, were entirely destroyed.

Bayer, Kunst, & Gewerbebl, 1851, p. 449.

ARTIFICIAL MODE OF COLORING MARBLE AND OTHER STONES.

Green.—A solution of verdigris colors marble light-green, but it does not penetrate into the marble deeper than one line.

Gamboge colors the marble yellow, when dissolved in hot alcohol, and applied warm.

A dark red color is produced with a solution of nitrate of silver in distilled water. This color penetrates deep into the marble.

A handsome red is made by a solution of dragon's blood in alcohol.

Chloride of gold stains the marble *purple-violet.*

Scarlet red is produced by a solution of cochineal in alcohol.

Smaraged-green color can be produced by a coat of a mixture of wax and distilled verdigris laid on in a warm state. When the mixture is coated, it is taken off. The color sinks in the marble four to five lines deep.

Sandal, *Pernambuco*, and like dye-woods, when treated with alcohol, make colors which give the marble beautiful tints.

Böttger, Polyt. Notizbl. 1850, p. 282.